MODERNIZING USAF ESCALATION CONTROL

Graduate Research Paper

Justin L. Gamel, Major, USAF

AFIT-ENS-MS-17-J-027

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT-ENS-MS-17-J-027

MODERNIZING USAF ESCALATION CONTROL

GRADUATE RESEARCH PAPER

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Operations Management

Justin L. Gamel, BS

Major, USAF

June 2017

AFIT-ENS-MS-17-J-027

MODERNIZING USAF ESCALATION CONTROL

Justin L. Gamel, BS

Major, USAF

Committee Membership:

Major Heidi M. Tucholski, PhD
Chair

Abstract

This Graduate Research Project (GRP) will assess how the United States Air Force (USAF) can implement escalation control operations. Escalation control theory models were once capable of predicting escalation with an accuracy up to 98%. However, the study of escalation control stagnated after the end of the Cold War. This GRP strives to revisit escalation control in two major phases. First, a qualitative literature review regarding escalation control and nuclear deterrence is used to formulate a qualitative interview question set aimed at a broad 'Whole of Government' research base. This interview pool includes senior leaders and experts across the Department of Defense (DoD), Department of Energy (DoE), and the US Government. The qualitative research interview combines the top ten escalation control principles found in the literature, and attempts to detect post-Cold War changes in escalation control dynamics. In the second phase of this study, quantitative analysis will be utilized to establish which areas of escalation control the USAF can improve upon. The areas of improvement recommended by this research include; 1) building more confidence in adversary behavior modeling, 2) auditing conventional plans for adversary nuclear thresholds, and 3) introduction of nuclear escalation control objectives into conventional Mission Type Orders (MTO).

To my wife and kids- thank you for your sacrifice during our service to this great nation.

Acknowledgments

I would like to express my sincere appreciation to my faculty advisor, Major Heidi Tucholski, for accepting the challenge of guiding a SANDS student throughout the course of this graduate research paper effort. Her quantitative research experience, mentorship, and feedback was crucial to the success of this research. I would also like to thank the men and women of the Nuclear Enterprise… your silent service still bears the burden of nuclear deterrence.

Justin L. Gamel

Table of Contents

Page

List of Figures

MODERNIZING USAF ESCALATION CONTROL

I. Introduction

Escalation control is chaos management on a global scale, and to comprehensively address the topic requires a 'whole of government' approach. It is important to note that escalation control does not occur solely within the USAF. During a 2016 visit to the School of Advanced Nuclear Deterrence (SANDS), acting Secretary of Defense, Dr. Ash Carter, stated that "Escalation control requires a whole of government approach balancing policy and strategy, otherwise any valid developments are prone to fail" (Carter, 2016).

Several potential adversaries have begun to signal their willingness to strike the United States and allies with nuclear weapons if they are threatened. This recent surge in adversary boldness has been met with U.S. efforts to reassure our allies that we are willing to extend our deterrence umbrella to protect them. However, little has been done to modernize how the U.S. Air Force addresses nuclear provocation using escalation control principles. If U.S. methods of escalation control are outdated and our signaling or operations are misinterpreted, there could be a sudden flash resulting in the loss of an army, a city, or even a country (Kahn, 1965; Kaufman, 1956). Thus, the potential consequence for failure in the field of deterrence known as escalation control is tremendous.

Background

Nuclear deterrence is a complicated endeavor. The word deter is derived from the Latin root, *deterre*, which means "to frighten from" or "to turn aside, discourage, or prevent from acting (Kunsman, 2001:19)." In essence, deterrence is both an art and a science,

focused on issuing threats to cause another to decide against an unwanted behavior (Payne, 2008: 22).

The U.S. is the first, and only, country to escalate to nuclear warfare. Since the abrupt end of WWII, nuclear weapons served as a deterrence against the Soviets in the Cold War. However, several problems have emerged which are complicating the effectiveness of escalation control and nuclear deterrence. First, after the Cold War ended, many other countries gained a nuclear weapon capability. This invalidates much of the dyadic Cold War deterrence strategy that was developed for a U.S. versus Soviet situation (Payne, 2008). Second, new combat arenas have emerged such as the cyber domain, which further complicate U.S. nuclear deterrence policy (Zagare, 2000).

As with baseline deterrence doctrine, escalation control not only requires the ability and the will to escalate, but it also requires that the adversary correctly understands (or at least perceive) that the U.S. is both capable and willing to escalate. The unique dynamic of escalation control is the mutual understanding between adversaries as to where, when, and how the general limits of each stage of conflict will occur. The primary escalation control mechanism that the U.S. employs today is known as escalation dominance, which means the U.S. is perceived by potential adversaries to be able to fight harder, longer, and more effectively at all levels of conflict.

Escalation theory was developed during the Cold War with two main goals. The first goal of escalation theory is to deter a conventional war from evolving into an exchange of nuclear weapons. The second, should deterrence fail, is to ensure that adversaries have a general understanding of the U.S. thresholds preventing escalation to higher levels of hostility. In 1965 a seminal book was written by Herman Kahn which proposed an

escalation ladder which is still used today. This ladder identifies more than forty levels of escalation that nations can potentially ascend or descend through during a conflict. Lower levels included non-military actions, whereas the top levels involve actions associated with major world wars.

Problem Statement

It is time for the escalation control theory to be revisited in order to address emerging thresholds for nuclear capable countries. Current U.S. nuclear deterrence policies are still very dyadic, and subsequent strategies are still being built with tunnel vision, looking at situations between two powers and failing to fully incorporate regional dynamics. This mindset may inadvertently trigger a third party intervention from a neighboring nation with mutual security concerns but differing political restraint.

Development of new domains of warfare such as cyber and grey-zone conflict complicate the battlefield and diplomatic arenas. In both emerging domains, the attribution of a hostile act can be difficult. In addition, detecting the massing of an adversary for a cyber or grey-zone conflict can also be very challenging for the intelligence community. Major barriers exist which detracts from ascertaining and resolving cyber force and grey-zone conflict capability gaps. These barriers include classification, cost, and unclear geo-political boundaries.

Finally, and most dangerously, adversary thresholds to use nuclear weapons may not be accurately understood and reflected in conventional operational plans (OPLANs). This dynamic expansion within the spectrum of engagement has caused our escalation policy to become outdated.

Nuclear deterrence theory within the USAF remains dyadic and, subsequently, USAF strategy does not always accurately reflect academic principles of escalation control. These incorrect applications of escalation control principles might force a circumstance where an adversary will escalate with a nuclear weapon because the USAF inadvertently crosses an adversary's known threshold for use. In other words, many current USAF conventional planners are not properly educated on U.S., allied, and adversary thresholds for nuclear escalation. Also, should a new threshold or red line be discovered there is doubt regarding the proper dissemination and re-education process is adequately responsive.

Barriers to resolving current issues include classification, cost, geographic separation, and differences in allied language and cultures. Great care should be taken to rectify this situation because of the danger of inadvertently crossing an adversary's nuclear threshold.

Research Objectives and Investigative Questions

The objective of this research is to assess how the USAF can operationalize and modernize the theoretical aspects of escalation control in order to provide means by which off ramps are made attractive to an adversary. Understanding the evolution of mid-1960's era theory of escalation will be utilized to underpin a modern aperture of global and regional developments in nuclear weapons and emerging domains such as cyber and grey-zone conflict. These efforts will be applied to recommend adjustments to how the USAF contributes to national security through escalation control. Therefore, the primary research question for this paper is:

(RQ) How can the USAF modernize and operationalize Escalation Control?

A thorough review of the literature will be utilized to outline the objective of this study, resulting in three investigative questions (IQ):

IQ1. How effective is the USAF at Escalation Control?

IQ2. What emerging dynamics affect Escalation Control?

IQ3. How can the USAF improve Escalation Control?

Research Scope

This research will focus on discovering how the USAF can improve escalation control principles without creating an entirely new deterrence theory. For that reason the theory of escalation control established in the 1960's will be used as a baseline model from which to view a modernizing environment. Recent policy research and escalation ladders will be compared and contrasted. However this research does not seek to produce a new escalation ladder.

This paper must avoid several topics which would detract from the focus of the research. First of all, this paper must avoid classified discussion in order to adhere to an unclassified level of information regarding current Operational Plans (OPLANs).

In addition, this research will introduce a Russian escalation ladder from an unclassified open media source. This study utilizes the example for academic purposes and does not imply the accuracy of the example.

Methodology

This research is conducted in two primary stages: 1) Qualitative research; and 2) Qualitative analysis. Qualitative research will be conducted to develop an understanding the principals of escalation control as it relates to nuclear deterrence. The primary mechanism for this qualitative research will be a literature review followed by face-to-face interviews. The literature review will be utilized to define escalation control principles through data obtained via academic sources. These sources include deterrence theory books, peer reviewed journal articles, observations, regulatory documents, and multiple nuclear deterrence conferences attended by the researcher. Significant findings from the literature review will shape the questions used during face-to-face interviews across a 'Whole of Government' research pool comprised of senior leaders from Department of Defense (DoD), Department of Energy (DoE), and the US Government House and Senate Armed Services Committees (HASC/SASC). Emphasis of the qualitative literature review and interview research will be placed on escalation principles, escalation objectives, and the USAF contribution to current escalation control.

Qualitative analysis will then be used to analyze the findings of the literature review and interview results. Qualitative analysis data will be represented graphically as a means of comparison between principles found in the literature review, DoD, DoE, and U.S. Government respondent inputs.

Once the qualitative research is complete this research project accomplishes a quantitative application of the most prevalent qualitative component of escalation control. In this case, it will be a short quantitative analysis of the statistical implications of a nuclear capable adversary.

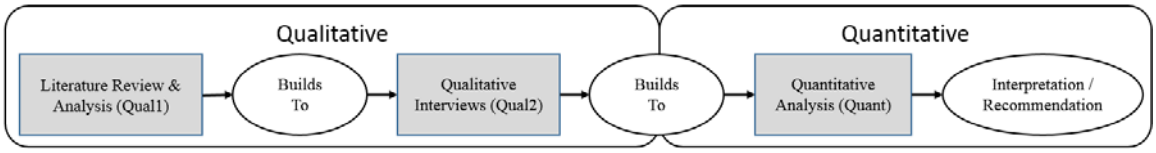


Figure 1. Exploratory Sequential Mixed Method, QUAL-quant (Creswell, 2014).

Assumptions

As with most research projects, certain assumptions must be made. The most fundamental assumption made is that the methodology for this study will provide meaningful insight into modernizing USAF escalation control. Qualitative research will provide an opportunity to obtain valuable insight from numerous senior leaders, policy makers, and strategists.

It is assumed that the participants involved in this research are senior level experts in their respective field of national security. It is also assumed that the responses represent the same views as a majority of other experts in their field. It is also assumed that the responses from interviewed experts are truthful and based on real world experience and years of training.

The focus of this study is to involve a mixed method research incorporating a literature review into an interview questionnaire. This method is utilized in order to reduce and mitigate any known or unknown bias of authors, the researcher, and interview participants. Graphical comparison between the literature review and interview responses will be used to eliminate any bias or skewed response.

A final assumption pertains to the consistency and accuracy of this research. Interview responses will be compared graphically with principles provided in the literature

review. It is assumed that statistical comparison is possible both mathematically and visually in order to ascertain the effectiveness of USAF escalation operations.

Limitations

This study will remain within the boundaries of several limitations. The first limitation resides with security and classification. It is possible for the researcher to access classified information. However, this study will publish only in the unclassified domain. Therefore, all discussion and recommendations for improving USAF escalation control will be unclassified initiatives for consideration. Also, any illustrations or examples will be provided for academic purposes only, and will not include linkages to real world Combatant Commands (COCOM), nuclear warfighting agencies, or control authorities.

The second limitation placed on this study is the decision not to focus on the feasibility of implementing any recommended organizational or operational changes. This study provides a framework from which senior leaders, policy makers, and strategists could base their organizational change decisions. This study does not address the logistical requirements necessary to execute strategic-level changes. As such, this study may provide an opportunity for future research based on qualitative analysis and case study research of nuclear deterrence and escalation control. Thus, this study will not determine financial, manpower, and other implications associated with any recommendations escalation control.

Implications

This research will enable a rigorous examination of the operational status of the USAF regarding escalation control theory. Application of the findings of this research will further enable the ability of USAF leadership and planners to advance escalation control. This improvement in escalation control will help the United States, as a whole, successfully signal an adversary that off ramps are available if they wish to de-escalate a situation involving potential use of nuclear weapons. Recommendations provided in this study will therefore strive to enable the USAF with;

1) Preventing adversary incentives for escalation above nuclear thresholds by dominating the balance of conventional power by the USAF.
2) Preventing adversary incentives for escalation above nuclear thresholds through an assured second strike retaliation by the USAF.
3) Preventing adversary incentives for escalation above nuclear thresholds by improved understanding of adversary perception of USAF using available adversary behavior models.
4) Preventing adversary incentives for escalation above nuclear thresholds by ascertaining adversary thresholds that would trigger a nuclear response, followed by an audit of conventional OPLANs and strike options to ensure thresholds are not inadvertently crossed.

Summary

DoD leadership has voiced the need to ascertain the USAF effectiveness at escalation control. Existing literature provides an overview of escalation theory, escalation ladders, and emerging factors that influence the decision-making processes when determining which escalation construct(s) to improve upon. Thus, escalation control will be studied qualitatively through literature, interviews and then improvements will be recommended with supporting quantitative application. Interview results and other

qualitative analysis will be used to answer this paper's investigative questions. Finally, conclusions from this study on escalation control or future research will be presented to the Air Force Institute of Technology (AFIT) and to Air Force Global Strike Command (AFGSC).

II. Literature Review

Background

Much academic debate and analysis regarding dyadic nuclear deterrence and escalation control was accomplished over the decades between 1950 and 1990. However, soon after 1992 something detrimental occurred to the academic rigor towards the study of nuclear deterrence– victory. This academic void is partially due to the Soviet Union collapse followed by the swift and successful conventional war by the U.S. in Iraq. Also, US Strategic Command was dissolved, and nuclear armed bombers were removed from nuclear alert. This 'peace dividend' phenomenon created an academic study shortfall which would last until the mid-2000s.

Escalation Control Theory Development

In 1961 an academic review of conflict history revealed that post-WWII hostilities were taking a new form. Academics began to wonder what this conflict pattern meant for humanity (Raser, 1966). It was during this time that conflicts began to take on a limited scope, meaning that the gradual onset of hostilities and gradual increase in intensity was vastly different than previous military engagements such as sudden Nazi blitzkrieg attacks. At first it was labeled as lower level conflict, or limited conflict, and was attributed to the residual psychological impact of WWII. It was also during this time that seminal authors Dr. Thomas Schelling and Dr. Herman Kahn were developing key nuclear deterrence theories for U.S. Government and military policy makers.

In 1965, a new concept called escalation control theory was developed by Dr. Herman Kahn in a seminal book titled "On Escalation." Several other others described the

same phenomenon known as escalation dominance and limited war. Escalation began to be defined by bargaining theorists as the deliberate violation of a saliency. Under escalation control a rational decision maker might be deterred from escalation because of fear of an inadvertent or accidental war (Young, 1968). In short, escalation control is the method that potential adversaries establish limits to a potential conflict. The following are the objectives, theory, and principles for escalation control.

Escalation Control Objective

War can escalate quickly, and often leaves both sides wondering what level of risk the other side is capable and willing to accept. Without some form of mutual limits to engagement a war could rapidly lead to large scale nuclear exchanges. Escalation control, as a function of nuclear deterrence, is aimed to provide multiple escalation decision points, each with an associated "exit ramp" in order to de-escalate the situation (Shelling, 1966; Kahn, 1965). This form of a mutually established decision point prior to crossing the next threshold is called an escalation decision point. Each decision point is associated with the cognitive decision to maintain current operations, decrease operations, or cross the threshold into a higher risk activity. Escalation control, in short, provides a mutually understood series of thresholds which becomes an opportunity for an adversary to consider escape in order to avoid further punishment.

Escalation Control Theory

As with baseline deterrence doctrine, escalation control requires three things to be effective. First, the U.S. must possess both the capability and the will to escalate. Secondly, and more importantly, escalation control requires that the adversary understands (or at least perceives) that the U.S. is both willing and capable to escalate. Both having the

capability and will to escalate are common between nuclear deterrence and escalation control. A third dynamic makes escalation control theory unique from deterrence. This unique effect offered by escalation control is that both sides of the conflict are provided with a general understanding of when, where, how, or why the other side would escalate to a higher level of engagement. This third dynamic, mutual understanding of thresholds, is what makes escalation control unique from baseline nuclear deterrence (Kahn, 1965).

According to Kahn's escalation control theory there are three primary types of escalation control used during conflict: vertical, horizontal, and temporal escalation (Kahn, 1965). These three types of escalation maneuvers are depicted below in Figure 2.

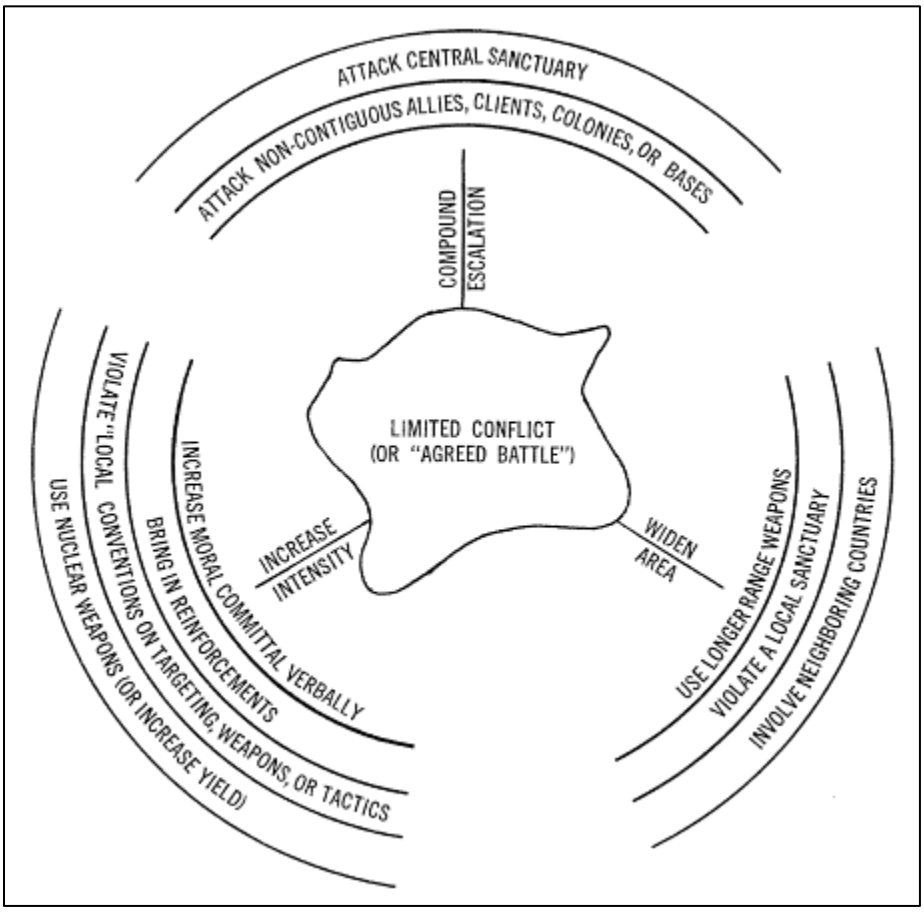


Figure 2. Three Escalation Control Maneuvers (Kahn, 1965)

On the bottom left of Figure 2 is the vertical escalation option. Vertical escalation describes a situation where the U.S. would increase the violence or damage being done. Kahn's ladder, discussed later, is a good example of a vertical escalation mindset. Vertical escalation options include increasing weapon quantity, yield, or attacking less defended targets in the same general area in order to increase probability of damage and casualties. It is important to note that the potential for vertical escalation to cross the nuclear threshold does exist, which by itself can serve as an influential deterrent.

The second escalation maneuver is called horizontal escalation and is depicted in the top of Figure 2 as compound escalation. Horizontal escalation is attacking at the same intensity as before, but in a separate geographic location to complicate defense plans. Horizontal escalation can cause the adversary to defend a much larger area. An example of horizontal escalation would be if Russian aggression in Europe resulted in a hostile response on Russian forces in the Pacific. Instead of retaliating in the same location, U.S. and NATO forces could attack anywhere along the Russian border from Europe to Asia, to include along the Eastern front from the Pacific Ocean. An aircraft carrier or tomahawk capable naval vessel is a good example of a conventional capability that provides horizontal escalation options to policy makers and strategists.

The third escalation control is temporal escalation and is depicted on the bottom right of Figure 2. Temporal escalation is the ability of the nation to swiftly increase or decrease the tempo of the operation. This ability to accelerate or decelerate operations can have a dramatic effect on military asset fatigue and supply chain supportability.

A good example of escalation control maneuvering is deciding how to respond to initial aggression from another nation. If provoked, a combination of vertical, horizontal,

and temporal escalation would be available. In this situation, deciding if the response would be conventional or nuclear would be a vertical escalation decision. Where the attack would take place would be the horizontal factor. Adjusting the tempo of the attack in each location would thus create a three-dimensional escalation helix that is formed from Kahn's vertical ladder.

Escalation Control Ladders

Nuclear war, however destructive, would involve political goals; at least at the outset. Secondly, states and leaders can be expected to recognize certain rules of the road about fighting and ending wars, despite cultural and national differences. Third, although time pressures and the military planning process impose constraints upon escalation control for war termination, success is not precluded in practice. (Kahn, 1965: 47)

Dr. Herman Kahn developed a conflict spectrum that included his escalation ladder. This ladder identified more than forty levels of escalation that nations can ascend or descend as necessary. Lower levels included non-military actions, whereas the top levels generally involved major wars and eventually a massive nuclear attack. The absence of general war among major powers (specifically nuclear powers) provides historical evidence for the benefit of nuclear weapons as escalation control mechanisms.

Early Escalation Control Ladders

Escalation control is chaos management. It is definitely beneficial to have a baseline plan going into the situation, but flexibility and cohesion will be critical between the US Government officials and the Department of Defense to ensure a synchronized response and maneuver to respond to hostilities. The following Figure 3 depicts a few

examples of escalation control concepts during the formative academic discussions of the 1950-1970 timeframe.

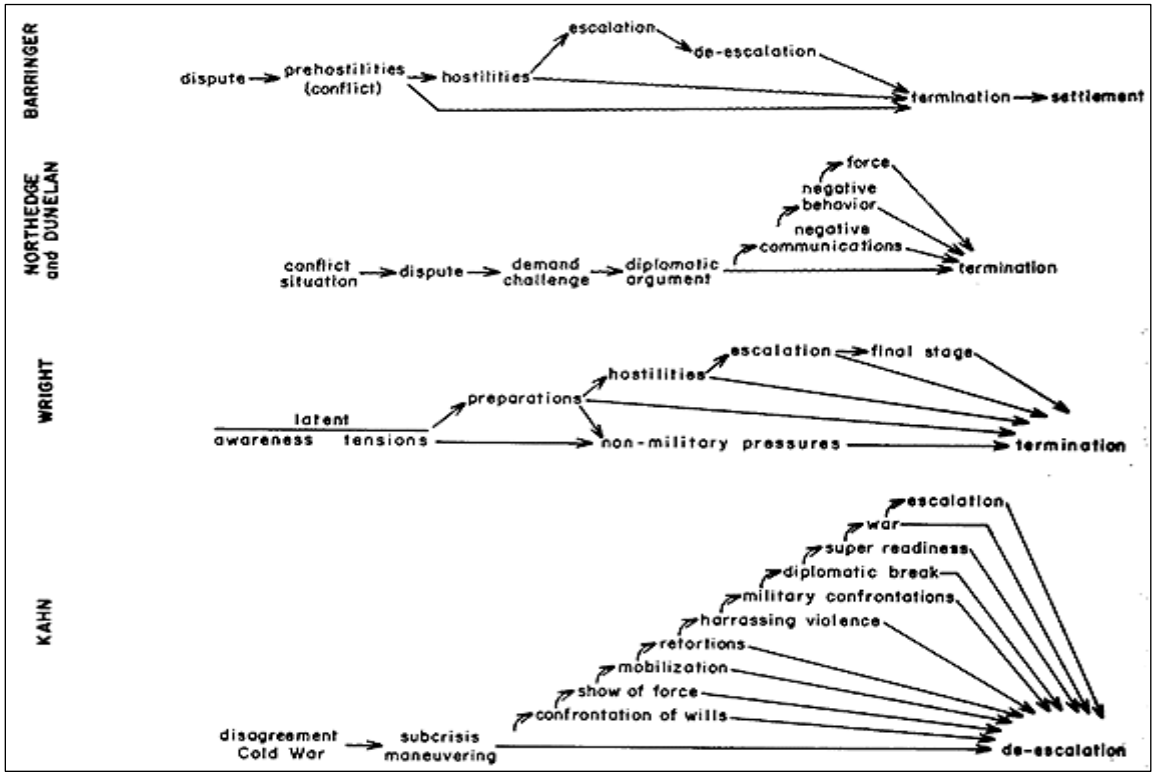
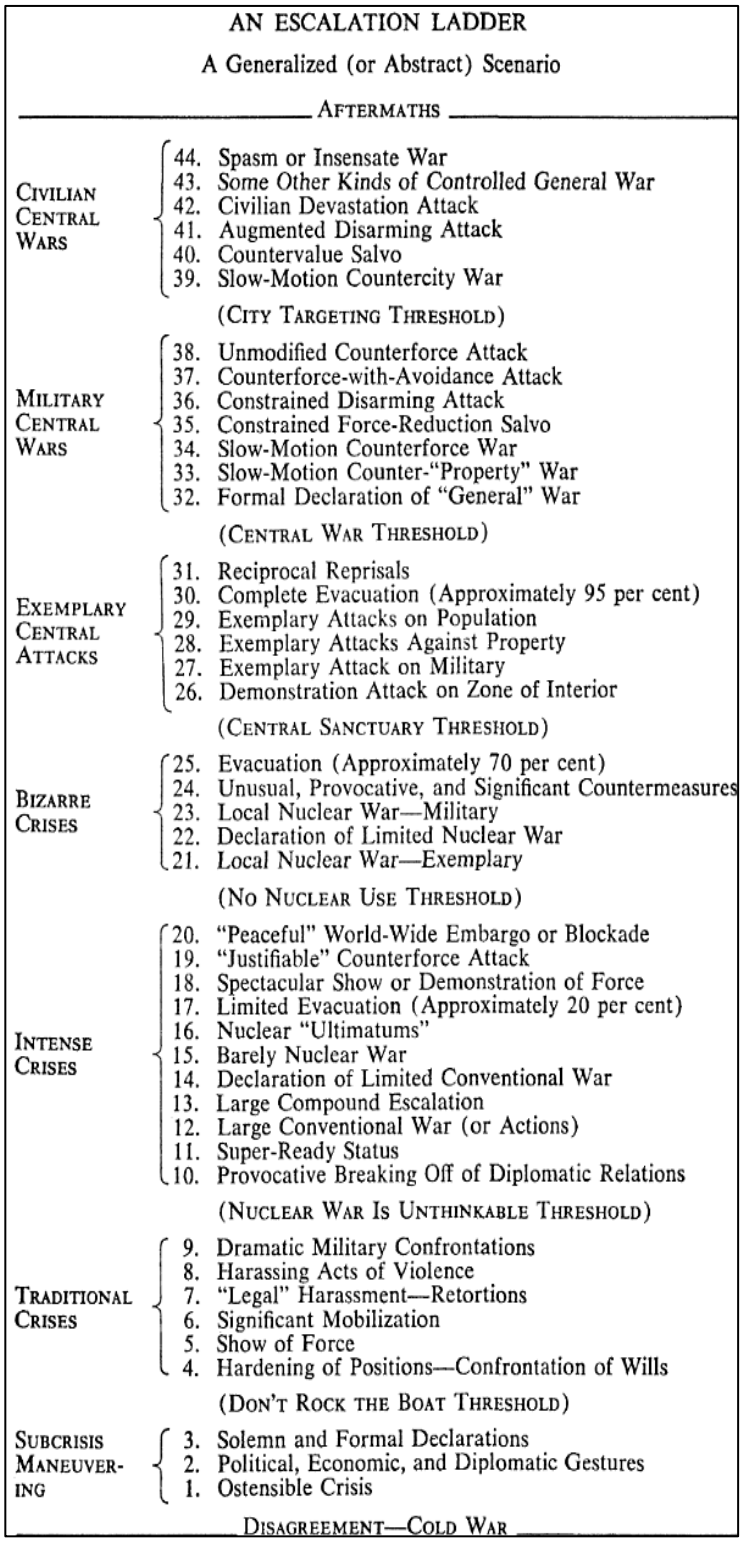


Figure 3. Example of Escalation Control Ladders 1950s-1970s (SANDS, 2016)

During the late 1950's and early 1960's the academic debate regarding nuclear deterrence theory was heated. Cold War provocations by the Soviets forced American Presidential Administrations into deep reflection on 'thinking the unthinkable' (Payne, 2008). Figure 3 depicts the four most prominent viewpoints of escalation control, each with increasingly more information or options available. A dyadic standoff between the Soviets and America was the primary lens through which the formative years of escalation control build escalation ladders to address increasingly complicated security issues.



In 1965 Dr. Herman Kahn published his seminal book, "On Escalation, Metaphors and Scenarios" which became the benchmark for academic discussion of escalation control. Figure 4 to the left depicts his seminal description of an escalation ladder. Much of his book centers on the explanation of each rung of this ladder. One aspect Dr. Kahn points out is that the escalation ladder is similar to a menu. Not all items will apply to all situations. Also, not all items appear in order in different situations. Finally, the thresholds between each items are not equal.

Figure 4. Seminal Escalation Control Ladder (Kahn, 1965)

Modern US Escalation Control

There is a difference between deterring the onset of hostilities and controlling the escalation of a dispute once deterrence fails. In other words, the onset of a dispute and the escalation of the dispute are interconnected yet distinct phases of an integrated understanding of the full spectrum of conflict (Reed, 2000). Therefore modern deterrence and escalation control strategists must not only strive to understand what deters an adversary from commencing hostilities, but also to what level of conflict an adversary is willing to pursue to satisfy political goals. Figure 5 below depicts the modern consensus of the relationship between deterrence and escalation control. The point at which conventional conflict begins is the primary initiation of escalation control operations.

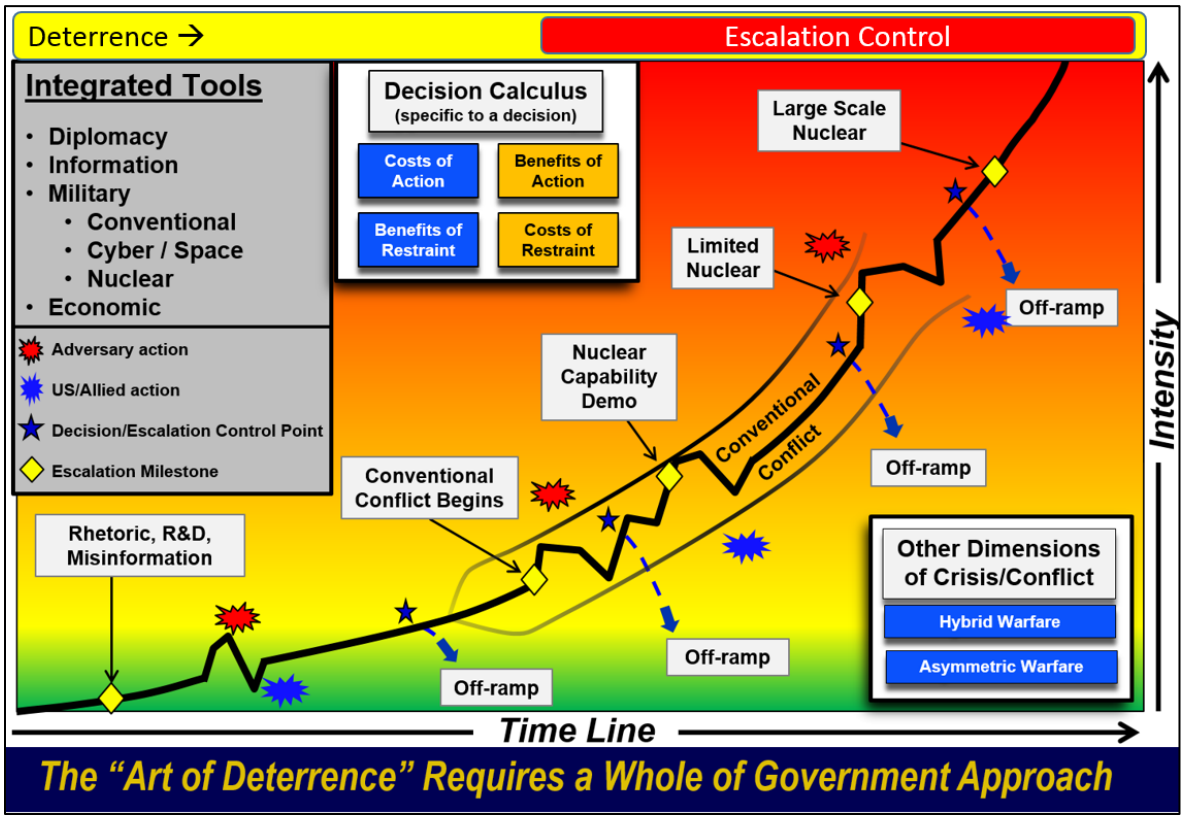


Figure 5. US STRATCOM Modern Deterrence & Escalation Control (Haney, 2016)

Figure 5 above is a depiction of modern US escalation control available at the unclassified level. This product originates from a public address by the Commander of US Strategic Command, and discusses the full spectrum of conflict against a nuclear adversary (Haney, 2016).

The most important detail that makes Figure 5 such a powerful example of modern escalation control is the yellow diamonds that depict escalation milestones. These milestones differentiate this product from baseline deterrence theory because it clearly depicts escalatory thresholds in the mind of USSTRATCOM. This product can therefore be considered indirect declaratory policy and an actual signal to potential adversaries. Figure 5 also correctly uses the theoretical definition of escalation control by establishing thresholds for conflict with associated off-ramps.

Figure 5 carefully depicts Escalation Control Decision Points as a blue star. This is the second most important aspect of Figure 5. As the conflict escalates in the depiction of the blue stars gets closer to the escalation milestone. This correctly reflects the shortened timeframe and reduced amount of accurate information available as a commander or policy maker proceeds to make decisions throughout the conflict spectrum.

After the first escalation control point and before the first milestone is a grey cylinder that encompasses the rest of the conflict path. This area can be described as the grey-zone of conflict. Understanding the 'Grey-Zone' of the conflict spectrum is a highly emphasized field in modern deterrence academia. This grey zone is where many adversaries now choose to maneuver. Figure 6 below depicts a Russian publication discussing considerations for Russian military operations in the 'Grey-Zone'.

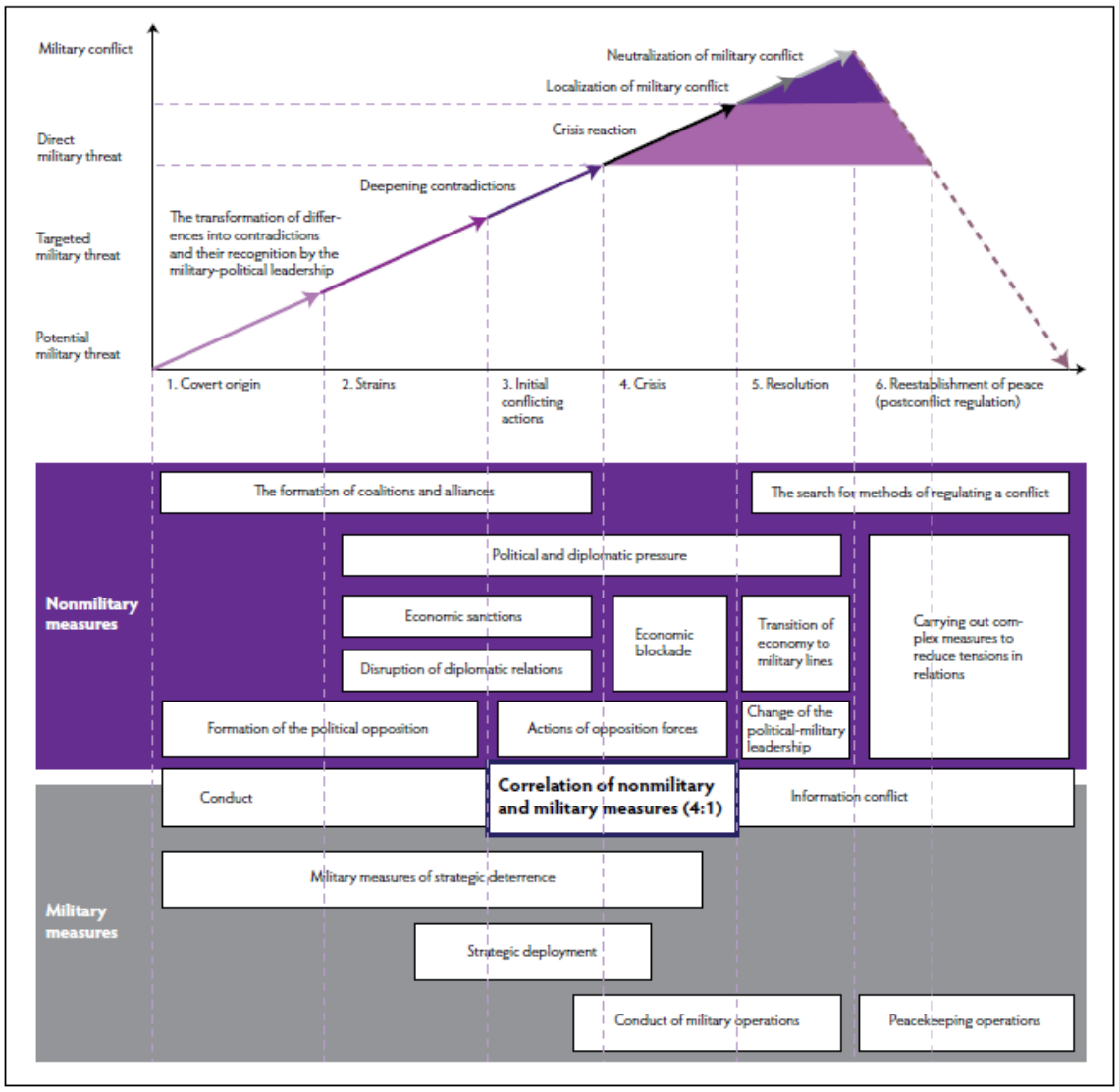


Figure 6. Russian Spectrum of Conflict and Escalation Control (Bartles, 2016)

Figure 6 above is categorized as an escalation control document because it also establishes thresholds for conflict intensity. However, this unclassified document demonstrates how modern Russian conflict depicts much more detail in the stages prior to the commencement of hostilities. Note the 4 to 1 ratio of non-military to military measures are dedicated to pre-hostility activity. This zone of maneuver is often called grey-zone conflict and is the topic of many modern escalation and deterrence studies.

III. Methodology

Methodology Overview

An exploratory sequential mixed method of research was selected for this GRP. To accomplish this, an initial qualitative research will be utilized to discover ways to improve escalation control. This qualitative research is based on a literature review focused on escalation control theory and escalation ladders. This literature review is followed by face-to-face or telephone interviews across multiple government and military agencies responsible for U.S. nuclear deterrence and subsequent escalation operations. The study will utilize interviews with senior DoD, DoE, and US Government policymakers, and their allied counterparts. Any significant findings during the qualitative data collection will be used to focus the quantitative data application that affects escalation control. Sample population will be focused on operational strategists, warfighters, and policy makers at the Brigadier General (O-7) level or higher.

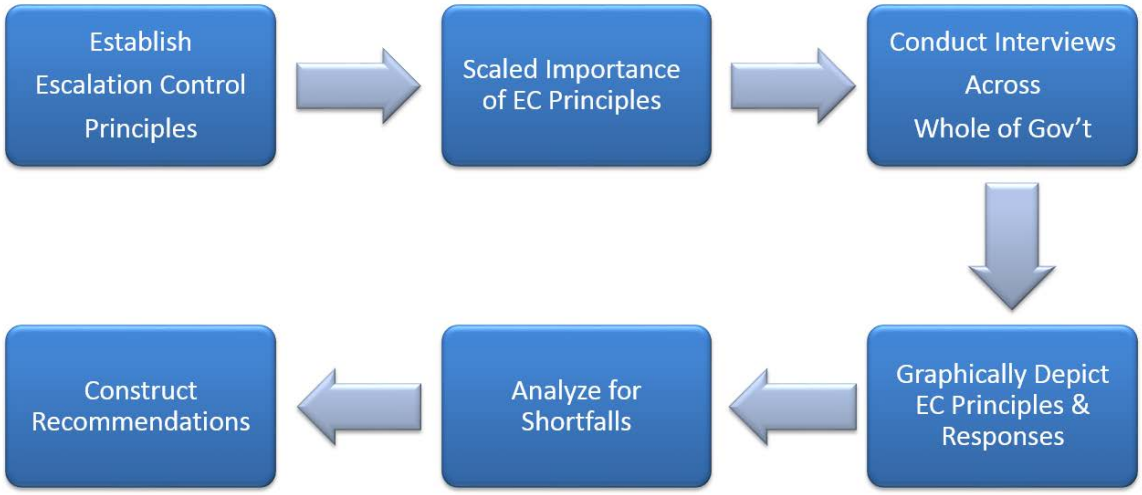


Figure 7. Methodology for Modernizing USAF Escalation Control

All research publishing will remain unclassified and will focus on a holistic assessment of USAF effectiveness at escalation control. This research will emphasize any quantitative analysis that directly reinforces significant findings of the qualitative stage (Creswell, 2014: 220).

The quantity of interviews in each department (DoD, DoE, US Gov) will remain equal in order to maintain a balanced cross-sectional study across the 'whole of government study.' In the event one department is represented by more interviews than another, an interview will be randomly selected to be removed to rebalance the inputs.

Emphasis of the research will be placed on the escalation control awareness, education levels, OPLAN relevance, space & cyber domains, regional dynamics, and threshold awareness. Finally, during the entire process the overall awareness of allied, third party, and adversary perceptions will be carefully assessed and documented.

Research Design

The primary strategy of this GRP is to compare the escalation control theory principles with current USAF operations from a whole-of-government perspective. Interviews with senior leaders, strategist, and policy makers enable a cross-functional perspective of USAF operations. Interview survey research is valuable with the goal of tabulating and analyzing responses so as to deduct opinions, attitudes, and experiences into a graphical comparison. Interview research for this study is conducted using an open ended series of questions as opposed to a written survey (Ormrod, 2013).

Both qualitative and quantitative analysis will be used to finalize and analyze survey results from the literature review and interviews. The recency of the final study

will ensure a rigorous and sophisticated combination of qualitative and quantitative method of study.

Qualitative Research

Qualitative research can be accomplished through a variety of methods; however, the methods accomplish the same result of focusing on phenomena of complex situations in order to interpret or define aspects that are truly important (Ormrod 2013). In order to build a holistic picture of escalation control, the exploratory and interpretive nature of qualitative research methods are heavily relied upon to effectively describe and explain the problem. For complex topics of study, it is not prudent to break down the entity into smaller digestible portions, but to represent the subject in its entirety in its natural setting. Thus, data collected would be from actual interactions and observations in lieu of synthesized laboratory experiments (Flick 2014).

The qualitative research method was selected, because the problem required an in-depth look that could not be provided solely through a literature review. In fact, existing literature is rather stagnant regarding escalation following the Cold War. Available literature focuses on nuclear deterrence in general, but not for escalation control as an operational perspective of the USAF. What existing literature does provide is valuable insight into initial fundamentals of nuclear deterrence and escalation control. This information provides a framework for which modern escalation control operations can be conducted by the USAF. This study does not formulate a hypothesis, but qualitative research allows for this. Therefore, this study will not test formulas, or concepts that are already known or established. Instead, this qualitative research was selected to pursue the

goal of re-discovering old ideas that might provide insightful improvements to modern perspective of USAF escalatory operations.

Interviews

Qualitative research has several popular methodologies. The primary methodology used in this study is the literature review enabled interview of senior leaders across a whole-of-government respondent pool. Supporting the interview is the utilization of an exploratory questionnaire. Using this questionnaire with the interview enables the ability to survey the respondents with "how much", "how well", or "what importance" type of questions that are necessary to collect and analyze data consistent with the needs of this study, and to facilitate comparison.

This design of the interview takes into consideration the five components of an interview case study: the study's questions, any propositions, the unit of analysis, logic linking the data to any propositions, and the criteria for interpreting the findings (Yin 2009). The study's main three questions are outlined in Chapter 1 as the investigative questions. Details of the interview questions are discussed in the next major section. The proposition of this study asserts that the senior leader, strategist, and policy makers have experience in nuclear deterrence matters and are exposed to real world escalation policy and operational plans. The three primary exploratory questions provide a necessary framework for analyzing similarities and differences among a range of various organizational structures. The unit of analysis for this study is clearly defined as an escalation control (EC) principle, of which there are ten. These ten escalation control

principles were selected due to the significance discovered during the literature review. Each principle is labeled as EC1 thru EC10 in Figure 8 below.

EC1	Balance of Conventional Power (Credible Conventional Deterrent)
EC2	Secure Second Strike (Credible Nuclear Deterrent)
EC3	Intelligence Accuracy / Adversary Behavior Modeling
EC4	Auditing Conventional OPLANs & Strike Options
EC5	Establishing Thresholds (Escalation Milestones)
EC6	Current Nuclear Deterrence Policy
EC7	Future Nuclear Deterrence Policy
EC8	Modernizing Nuclear Enterprize (B-21, B-61, LRSO, SLEP)
EC9	Emerging Domains (Space, Cyber, Hybrid, Grey-zone)
EC10	Signaling Effectiveness once Conflict Begins

Figure 8. Top Ten Escalation Control Principles

Each of the escalation control principles were input into a graphical form following the literature review. The purpose of the graphic is to establish the importance of each escalation control principle in relationship to each other. Also, follow on interview responses from DoD, DoE, and US Government will be added to the same graphic for analysis.

Linking data to the study's objective is accomplished in two methods. The first method is simply explanation of the ten escalation control principles, EC1 thru EC10. The second method involves pattern matching. Data obtained from surveys will be aggregated and represented pictorially. For comparison sake, the information provided from the literature review allows the creation of pictorial representations of escalation control principles discussed in the analysis and literature review. Finally, determining criteria for

interpreting findings is typically an underdeveloped component in interview case studies (Yin 2009). The interview research portion of this study ultimately uses a numbered response for each survey question as the variables to be input into a graphical depiction of respondent inputs. Once completed, the 2017 Escalation Control Analysis can be depicted graphically.

Data Collection

The goal of data collection for this study is to rely on more than one source of information. In doing so, the results will be much more credible as data not only becomes verifiable, but also potentially converged into facts (Yin 2009). To build the initial concept of what the USAF escalation control operations would look like, this study will rely on sources such as regulatory documents, deterrence policy, personal experience, individual Air Force organization's website, email correspondence, and presentations.

Data Analysis

Data analysis will consist of two components. Content analysis will be conducted on the policy, operational plans, and other data collected to determine the applicability of proper escalation control within the USAF. In addition, interview responses designed to address investigative questions will be answered with the support of pictorial representations. The results from the qualitative literature review and interviews will subsequently be aggregated and displayed visually as an analytical graphic. Similarly, information from literature review research, is used again in the analysis section to underpin the theoretical aspects of respondent inputs. The resultant theoretical models and details of the descriptive graphic analysis are presented in Section IV.

Data Sources and Format

The remaining pages consist of the actual survey questions. Survey questions are divided into ten different sections and are constructed to answer questions pertaining to ten escalation control principles designed to satisfy the research objective. Each section incorporates an additional remarks section for respondents to clarify or expand on any response provided. A larger remarks section to allow respondents to offer additional opinions or attitudes. The three interview questions are designed to independently characterize current USAF escalation operations, search for changes in escalation dynamics, and search for improvement areas for USAF escalation operations. Therefore, each interview consists of a specific set of rehearsed questions that the respondent is aware of before the interview begins. Response inputs are fixed at four options, which reduces the complexity of the design parameter in question. Numbers assigned to the responses are not emplaced to represent scaling, but to indicate a position in a resultant graphical depiction of the response.

With three bar graphs aligned side by side, one could easily compare and contrast the three companies (Daft 2013). The graphical depiction of the interviews is founded on that precedence, but was modified to meet the needs of this study. The graphical depiction of the qualitative interviews contains data entry fields in which a numerical value (0 – 4 for this survey) are entered. Upon data entry, the graph applies the numerical variable to what Microsoft Office© products refer to as a "bar" chart. Figure 9 below illustrates how the senior leader perspectives will be aggregated and modeled to present a picture of USAF escalation operations as a whole. The resulting graphic provides an analysis tool once all design parameters have a numerical value entered.

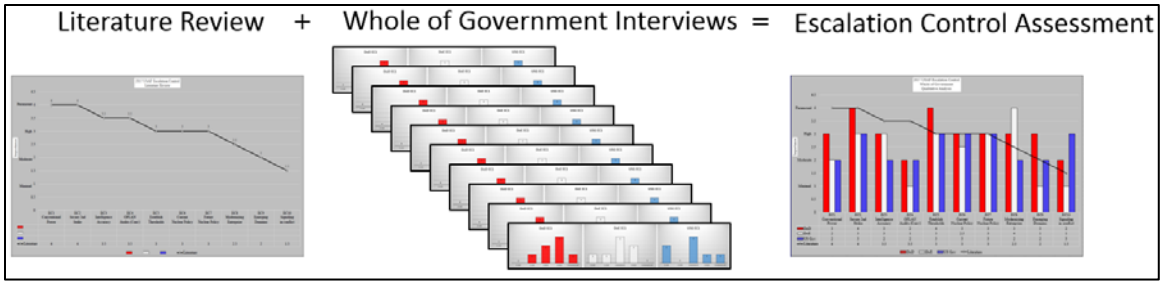


Figure 9. Systematic Research Structure

Data Analysis and Response Coding

Response coding will be accomplished using literature review principles of escalation control. Nine of the ten escalation control principle, EC1 through EC10, were derived from expected topics found in the literature. In one case an additional escalation control principle was introduced after the first interview with a Department of Energy (DoE) official. This unexpected code involved adversary behavior modeling and became the third priority finding of the overall study (EC3- Intelligence Accuracy.)

For each escalation control principle, the variable "0" indicates no response or not applicable. The variable "1" indicates the principle is of minimal significance to the respondent. The variable "2" indicates the principle is of moderate significance to the respondent. The variable "3" indicates the principle is of high significance. Finally, the variable "4" indicates the principle is of paramount significance, meaning that deterrence would fail under almost all situations should that principle be violated.

Qualitative Validity and Reliability

Every effort was made to ensure validity of respondent inputs are reflected accurately. This was done in three ways. First, respondents were notified of the research question and three investigative questions so as to not be caught off-guard by the topic of

the interview. However, the researcher did not disclose the ten escalation control principles that were being accessed during the interview. The escalation control principles, EC1 through EC10, will be passively introduced during the interview discussion in order to ensure a genuine and unprepared response from the respondents. Second, a standardized interview sheet was used to document and review respondent inputs. This interview record is found in Appendix A. The standardize format ensures that the interview covers the appropriate overt and discrete research topics and can be quickly and accurately recorded in the process of the discussion. Third, and lastly, each respondent was provided a copy of their inputs and afforded the opportunity to add, modify, or remove responses. Respondents were made aware of their ability to withdraw their comments at any time prior to publishing. This member checking is accomplished to maximize analysis validity and reliability.

Triangulation

Every effort was made to detect information that is prevalent in the literature review, interviews, and discussed during nuclear deterrence conferences. In this way the information or evidence from multiple sources offers an increased coherence regarding escalation control. These themes were gathered into the top ten escalation control principles, EC1 through EC10. Each principle will be discussed in individual detail in Section IV: Analysis and Results. A broad summation of the differences between literature review results and interview results will be discussed in Section V: Conclusion and Recommendations.

Participant Selection

This study targets senior leaders in command positions with significant roles within the DoD, DoE, and policy makers and strategists in the US Government. To maintain confidentiality, this paper will not provide specific names or offices. However, in general terms, senior leaders invited to participate in this study are subject matter experts from;

1) Headquarters Air Force (HAF). Air Staff and Special Staff leaders provide insight from the uppermost echelon of the Air Force.

2) United States Strategic Command (USSTRATCOM). Senior Air Force and Navy leaders provide insight from the strategic viewpoint of the Combatant Command tasked with Strategic Deterrence and nuclear operations.

3) Major Commands (MAJCOM). Directorate level leadership and strategists from four MAJCOMs provide insight from the Organize, Train and Equip (OT&E) perspective.

4) Numbered Air Forces (NAF). Senior leaders from Twentieth Air Force and Eighth Air Force provide perspective from the operational level.

5) Office of the Secretary of Defense (OSD). Senior leaders, strategists, and policy makers provide holistic perspective spanning across all branches of the U.S. military. Provides top level policy perspective as well as military impact.

6) Congress. Staffers from both the Senate Armed Services Committee (SASC) and the Congressional House of Representatives Armed Services Committee (HASC) provide insight into governmental procedures, funding, and policy perspective.

7) National Security Council (NSC). Senior members of the National Security Council tasked with periodic reporting to Congress and White House officials regarding nuclear deterrence and escalatory policy.

8) Department of Energy (DoE). Senior policy makers and representation of the scientific backdrop behind nuclear capabilities offering unique contributions to the NSC, HASC, SASC, White House officials, and intelligence community.

9) National Laboratories. Sandia, Los Alamos, and Lawrence Livermore National Laboratories offer expertise regarding technology, intelligence, adversary behavior modeling, deterrence policy, escalation operations, and a vast array of historic, present, and future technological capabilities.

Furthermore, this study also requires that the individuals in those positions or offices be at least the military rank of Colonel or higher, or the civilian equivalent. This requirement is instituted to ensure the greatest probability that the respondent would have experience and understanding in the realm of USAF deterrence operations. The individuals are informed that they were selected based on their knowledge and current or previous role. Individuals are also informed that their participation is voluntary and completely autonomous.

Pre-test

As an essential step in survey research, a pre-test of the survey was conducted to ensure each question would be clearly understood, free from administrative errors, and was specific in its intent and focus (Singh 2007). Four individuals were selected to review the survey and were asked for feedback with regards to improvements, clarifications, or general errors. The four respondents were all Majors in the United States Air Force with experience in GRP requirements. All four individuals that were asked to review the survey responded for a 100% response rate. Other than a few minor grammatical errors, the majority of the feedback focused on clarifications within the response parameter selection of 0-4. The survey was edited based on pre-test inputs to provide a higher quality product designed to maximize clarity and improve accuracy of responses. One round of pre-testing was conducted.

Interview Questionnaire

This section provides an overview of the interview questionnaire designed for the study. The entire questionnaire as it was administered can be found in Appendix A. The interview questionnaire was developed to gather data pertaining to USAF escalation control operations consisting of two pages per respondent. The first page is an informational page providing individuals selected to participate in the survey with 1) purpose of the survey; 2) participation statements; and 3) a confidentiality statement. The questionnaire will not ask for demographical information due to the irrelevancy of that information to the questions being asked and the fact the number of individuals requested to participate is relatively small.

Escalation control principles 1-10 were selected based off research conducted during the literature review. These principles were scored and placed in priority order as EC1-10. For example, one document focused heavily on auditing conventional operational plans to ensure that conventional warfare options do not cross known nuclear thresholds of the adversary. That characterization correlated to the Response 4 (EC4 Auditing conventional OPLANs) under the interview questionnaire.

During the interview, the respondent will only be aware of the research question and the investigative questions. However, the respondents will not be aware of the ten escalation control principles that are intended to be discussed. The researcher will introduce each escalation principle in casual conversation if the respondent does not unknowingly discuss any of the top ten escalation control principles. In this way the researcher hopes to obtain a genuine response from each respondent.

IV. Analysis and Results

Chapter Overview

Analyzing qualitative research relies heavily on inductive reasoning and the application of categorization in order to draw conclusions. Although this limits objectivity, the analysis will often bring interesting insights to light that might have otherwise gone unnoticed (Ormrod 2013). This GRP involved the collection of data necessary to visualize escalation control. This chapter begins with a description of the data collected during the literature review and interview survey, and is followed by a discussion of the results of the data collection as it relates to the three investigative questions posed by this research project.

Data Collection, Analysis, and Results

Data collection for this study began with a review of archival data, deterrence and escalation control theory books, peer reviewed articles, and personal interviews. The study of escalation control as a subset of nuclear deterrence is a challenge; therefore, data collection could not be limited to a specific organization. Qualitative content analysis was conducted due to the inherent ability to analyze documents and search for underlying themes (Bryman 2004). Through content analysis, categories emerge from literature data in order to extract contextual meaning during interviews. Through a strategy of integrating different materials and evidence, regulatory documents, working archival records, personal experience, individual Air Force organization's website, email correspondence, and presentations were analyzed for applicability to escalation control and was utilized to formulate and ascertain Investigative Question 1-3 (Kohlbacher 2006). Approximately

half of the data came from previous work that deterrence theorists produced in the 1950s and 1960s during the formative years of nuclear deterrence theory. However, there were some gaps identified in the listing. For example, there were fewer academic sources following the end of the Cold War.

Data collection contributing to the remainder of the investigative questions, and primary focus of this study, was obtained through research executed through face-to-face interviews. Analysis of survey responses was conducted based on simple descriptive statistics and survey participant comments. Survey results were tabulated to obtain modal selections and senior leader comments were used to support statistical analysis and to explain the complexity of escalation control. Confidentiality was afforded to participants; therefore, no names or specific organizations are provided or cited in this study.

A total of thirty interview invitations were distributed to senior DoD, DoE, and US Government officials. This broad 'whole-of-government' approach to research was carefully selected based on position and rank supporting nuclear deterrence and escalation control. The survey participants were given 90 days to accept the interview invitation with an official closing date of 1 Feb 2017. At the conclusion of the interview period, twenty three of the thirty responses were accepted for a 76% response rate. In an effort to retain a balanced response basis across the whole of government, equal quantities of responses were utilized in this study. For that reason one DoD and one US Government response was randomly selected to be removed from the analysis portion. This resulted in seven respondents for each of the three categories from within the whole of government interviews.

Analysis

The following is a visual depiction of the study method to illustrate how the literature review was combined with the interviews in order to compile a holistic analysis of escalation control.

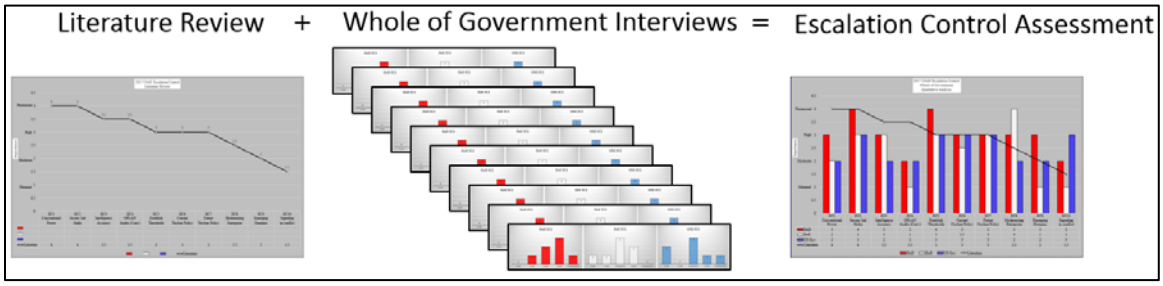


Figure 10. Systematic Research Structure

The ten escalation control principles were assimilated and scored during the literature review. The following is a graphical depiction of the top ten escalation control principles with the assessed importance for each.

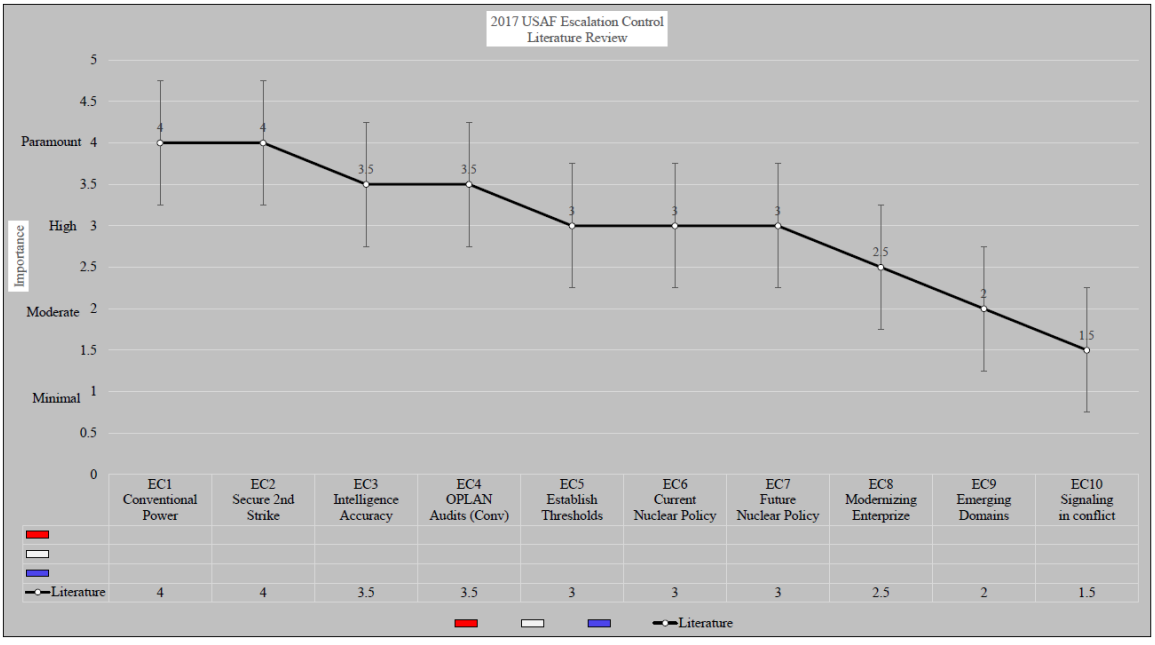


Figure 11. 2017 Escalation Control- Literature Review Analysis

Figure 11 graphically depicts the relevance of the ten escalation control principles. The escalation control principles were depicted in declining order of priority. EC1 and EC2 are of the utmost importance and were assigned a score a '4' of '4' in order to reflect that they are of paramount importance. EC3 and EC 4 both scored between a '3' and a '4', and were therefore depicted as a '3.5'. The following three principles, EC5-7, all scored as a highly important aspect of escalation control. The final three principles, EC8-10, all scored in incrementally lower priority than the previous. The purpose of Figure 11 is to single out the highest priority principles of escalation control theory found in the literature. This information was utilized to construct the interview questions.

This study will now provide a systematic review of each of the escalation control principles according to interview responses. During this review the responses from top DoD, DoE, and US Government officials were tabulated for comparison to each other. Take note that the literature review score is not depicted. This will be combined in a later section. Seven responses were retained for each of the three main focus study populations. DoD responses are depicted in red, DoE responses in white, and US Government responses in blue. Seven responses from each field are used for graphical analysis in this study. Any field with excess responses were randomly selected for removal to eliminate any bias from the researcher or unbalanced responses.

Take careful note that all three bar graphs may not be of the same max value. For example, there are several bar graph examples where a tabulation of '4' appears to be at the same height as a tabulation of a '3' response.

EC1: Balance of Conventional Power (Conventional Deterrent)

Much literature is available to support the escalation control principle of a dominant conventional force. For example, a group of researchers published a method to validate Rational Deterrence Theory in 1993. This quantitative process assessed 97 conflicts from 1816 and 1984. Major findings from the qualitative assessment highlight that maintaining a dominant balance of force does have a statistically significant impact on great power conflict (Huth, Gelpi, Bennett 1993). As seen in Figure 12 below, the Balance of Forces provides a positive correlation between conventional military dominance and the onset of hostilities. In other words, 74% of the time a dominant conventional military force is statistically proven to deter hostilities from a weaker nation ($n = 97$, $p < 0.05$).

Probit Estimates of Effects on Deterrence Outcome across Various Models

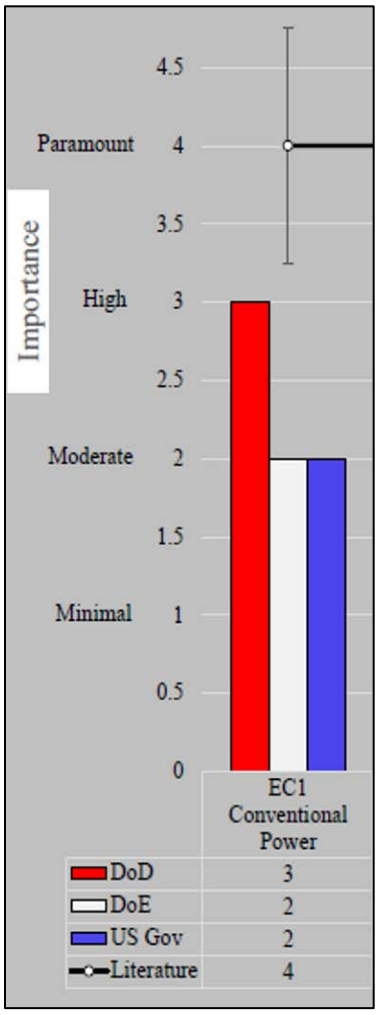
VARIABLES	MODEL1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
Constant	−.73 (1.07)	−.95 (1.24)	.35 (3.15)	−.59 (2.32)	−.71 (1.37)
Deterrence theory					
Balance of forces	1.59 (.89)**	1.72 (.90)**	1.69 (.92)**	1.53 (.90)**	1.73 (.94)**
Secure 2d strike	−2.58 (.92)****	−2.59 (.77)****	−2.60 (.78)****	−1.77 (.61)****	−2.33 (.83)****
Defender vital interests	−1.14 (.42)****	−1.30 (.45)****	−1.34 (.46)****	−1.22 (.45)****	−1.29 (.46)****
Challenger vital interests	1.08 (.42)****	1.09 (.42)****	1.09 (.43)****	0.93 (.41)***	1.09 (.44)****
Defender backed down	1.09 (.43)****	1.37 (.47)****	1.36 (.47)****	1.14 (.44)****	1.23 (.46)****
Challenger backed down	−.62 (.54)*	−.66 (.55)*	−.63 (.57)*	−.81 (.56)*	−.72 (.57)*
Defender other dispute	.75 (.39)**	.92 (.39)***	.94 (.39)****	.99 (.41)***	.96 (.42)***
Challenger other dispute	.03 (.37)	−.004 (.36)	−.02 (.37)	−.05 (.41)	.05 (.41)
Percentage correct predictions	73	73	72	74	76

Notes: n = 97. Standard errors are in parentheses. Significance tests are one-tailed except for the structural-realist variables interacted with *Risk-acceptant*, which are two-tailed.
*$p < .15$.
**$p < .05$.
***$p < .025$.
****$p < .01$.

Figure 12. Conventional Balance of Force (Huth, Gelpi, Bennett 1993)

The onset of conventional conflict is the first salient escalation control threshold in the literature. Thus, it is logical to offer that if a nation is able to deter the onset of conventional conflict, then the likelihood of escalation to the nuclear level is greatly reduced.

Therefore, conventional balance of power is the first escalation control principle, EC1. Empirical analysis is consistently able to directly correlate, throughout history, that a military balance of power reduces the potential for the onset of hostilities. In short, the nation with a dominant balance of power is much more likely to deter. On the other hand, a nation with a lesser military capability is less likely to initiate conflict. Multiple quantitative studies, such as the previous example in Figure 12, directly associate the balance of power with the potential for the onset of hostilities.



This study therefore coded EC1 as the most important aspect of deterrence and escalation control alike and subsequently scores EC1- Conventional Balance of Power as a '4- Paramount'. This is the highest score possible during this study as depicted in Figure 13 to the left as a black line with a white point. With a conventional balance of power there is also empirical data to support that escalation control will be maintained should hostilities commence.

The error bar in Figure 12 represents a +/- 0.75 error for the literature review score assessment of '4' for EC1. None of the respondent pools across the whole of government viewed EC1 in the same light, within +/- 0.75, as the literature.

Figure 13. EC1- Balance of Power

Figure 14 provides the whole of government breakout of responses from face to face interviews based on the following available responses for EC1;

0. Unknown
1. Minimal
2. Moderate
3. High
4. Paramount

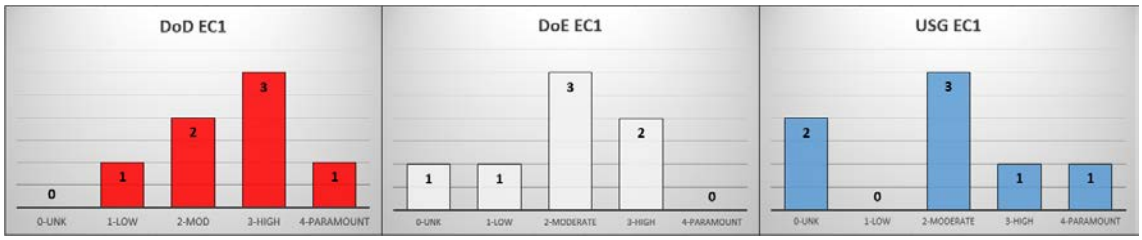


Figure 14. EC1: Balance of Conventional Power (Interview Responses)

DoD interview respondents predominately scored conventional balance of power as a '3-high' importance. However, both DoE and U.S. Government respondents listed EC-1 as a '2-moderate' importance. The most predominant feature of the responses is the insight by military leaders into the value of a dominant force. The most prevalent DoD response is summarized below,

> *"…maintaining a dominant conventional military is one of the best ways to prevent hostilities from commencing in the first place. However, a dominant and overwhelming conventional force can be a trigger for a counterforce nuclear strike. Therefore, projecting a dominant conventional posture to maintain peace must be weighed against the vulnerability to a counterforce strike."*

There was one seminal theorist, Dr. Thomas Schelling, who postulated an opposing view to EC1 being the most important factor in deterrence. Dr. Schelling

offered that an overwhelmingly dominant conventional force may drive an adversary to escalate directly to a nuclear counterforce strike. This argument is considered a valid argument when considering that desperate adversary may revert to illogical action if threatened with annihilation (Shelling, 1965).

Therefore, this study finds that an increased understanding is needed regarding the role EC1 takes in ultimate nuclear deterrence and escalation control. The literature supports that a dominant conventional parity prevents the onset of hostilities. However, an overwhelmingly dominant conventional force may attract a counterforce nuclear strike aimed to rebalance the conventional domain.

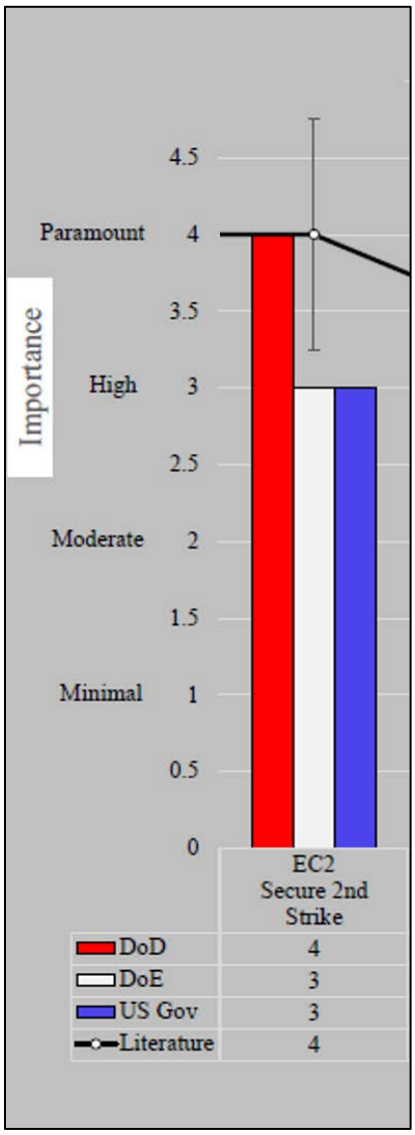
EC2: Secure Second Strike (Credible Nuclear Deterrent)

EC2 was determined to be a secure second strike, otherwise known as an assured nuclear response capability. A secure second strike is defined as the ability to retaliate with a credible nuclear attack, event after a surprise nuclear attack (Huth, 1993). A secure second strike is also a paramount principle of deterring an adversary from crossing the nuclear threshold of escalation control.

Recent analysis by Dr. Matthew Kroenig reveals that nuclear armed states are not threated by inferior nations (Kroenig, 2017). This dynamic is similar to EC1 because both involve the fundamental aspect of military parity. The nation that is perceived to be the most resilient to a nuclear strike and maintain a credible nuclear response is therefore in the advantage (Kahn, 1965; Shelling, 1966). Figure 15 below depicts a historic rate of 0% for nations threatening a stronger nation from 1945-2001. An important aspect of EC2 is not just owning nuclear weapons, but also having the ability to absorb a surprise attack and respond with a credible nuclear attack.

Country	Threats against Nuclear Superior States	Threats against Nuclear Inferior States
United States	0	17
Great Britain	0	9
Soviet Union	0	7
South Africa	0	6
China	0	3
France	0	3
Israel	0	3
India	0	1
Pakistan	0	0
Total	**0**	**49**

Figure 15. Compellent Threats by Nuclear-Armed States, 1945-2001 (Kroenig, 2017)



The literature review consistently listed a secure second strike as a paramount, or indispensable, principle of escalation control. Multiple quantitative studies were able to directly link, with a positive correlation, a credible nuclear response with the reduced onset of hostilities. For that reason the Literature Review Score is '4- Paramount' for EC2- Secure 2nd Strike. This is the highest score possible during this study.

The error bar in Figure 16 represents a 0.75 error for the literature review score of '4'. The responses from the whole-of-government perspective placed at least a '3-high' importance on EC2. The DoD experts in USSTRATCOM and within strategy and planning divisions offered a higher response level of importance than the DoE and U.S. Government.

Figure 16. EC2- Secure 2nd Strike

DoE and members of the Armed Service Committees all acknowledged that a secure second strike is of high importance. However, only DoD responses scored the USAF's ability to offer a credible secure second strike within the +/- 0.75 of the literature review score.

Keep in mind that Figure 16 above and Figure 17 below are designed to reflect how DoD senior leaders ascertain that the USAF enables EC2. This depiction does not attempt to reflect the effectiveness of DoD, DoE, or US Government on escalation control. Figure 17 below provides the breakout of responses based on the following available responses:

0. Unknown
1. Minimal
2. Moderate
3. High
4. Paramount

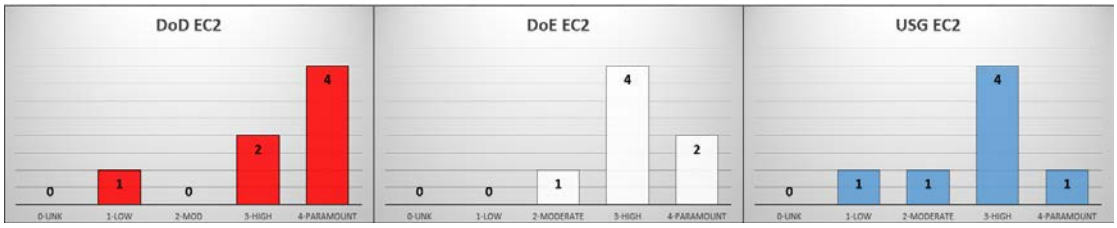


Figure 17. EC2: Secure Second Strike (Interview Responses)

All three areas of study provided a statistically significant response. This study therefore concludes that the DoD viewpoint is that the USAF is consistent with the literature while enabling EC2. Only three of responses varied from the primary response in all response pools across the whole of government. DoD responses primarily placed a paramount importance on a secure second strike. Both DoE and U.S. Government responses only placed a high importance on EC2. The following is an appropriate summation of responses to the respondents view on EC2.

> *"…the key to nuclear deterrence and escalation control is not simply the possession of nuclear weapons. It lies in the adversary understanding that we have the capability, and fortitude, to absorb a surprise nuclear attack and then respond in a way that imposes unacceptable damage."*

EC3: Intelligence Accuracy (Includes Adversary Behavior Models)

EC3 was determined to be intelligence accuracy, which includes the ability to review adversary behavior models. Although never perfect, accurate intelligence provides more efficient application of power and diplomacy. Intelligence accuracy is assessed by the literature as a highly important principle when determining the effectiveness of escalation control. Having an accurate understanding of the 'perception of an adversary' enables decision makers to deter the onset of hostilities and establish escalation control milestones. Figure 18 below is an unclassified depiction of a DoE behavior model that can be utilized when making senior policy and military decisions.

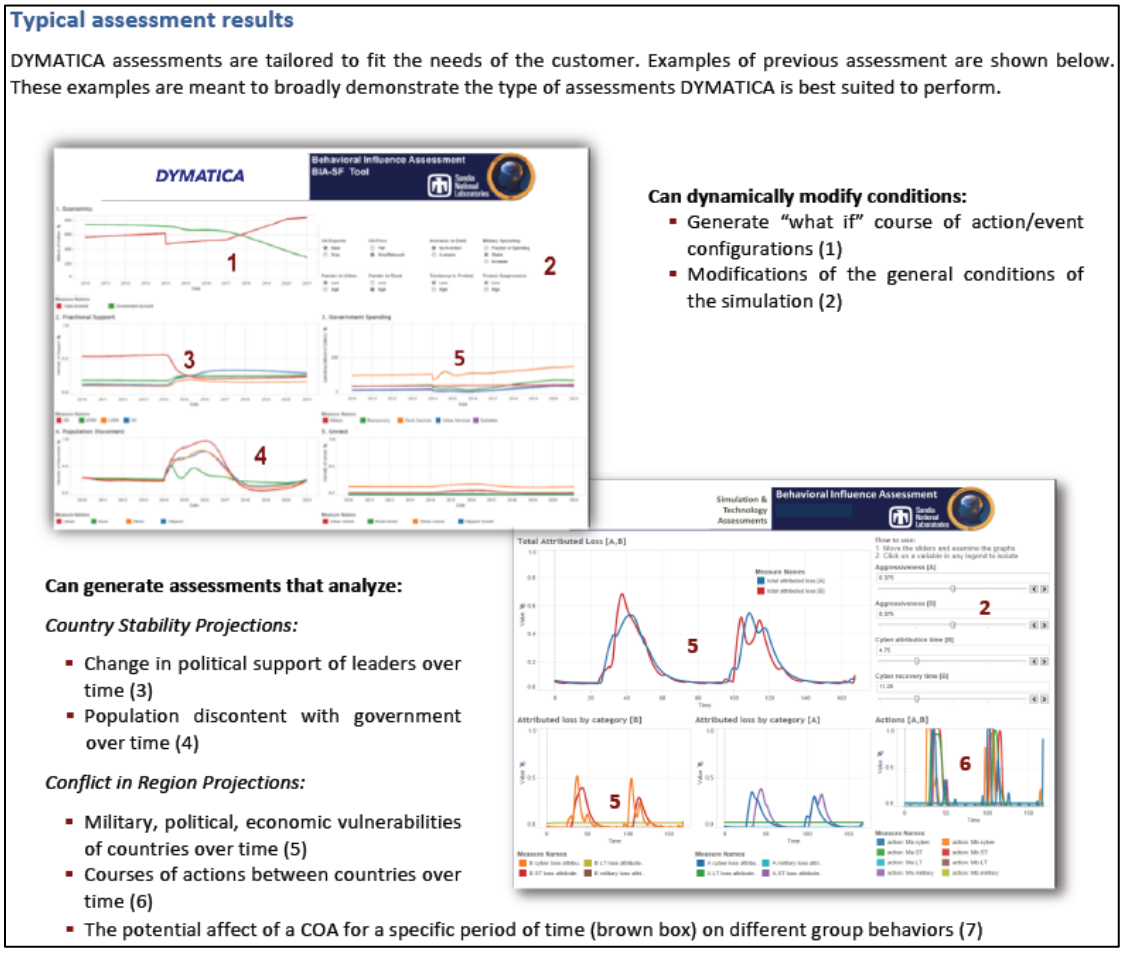
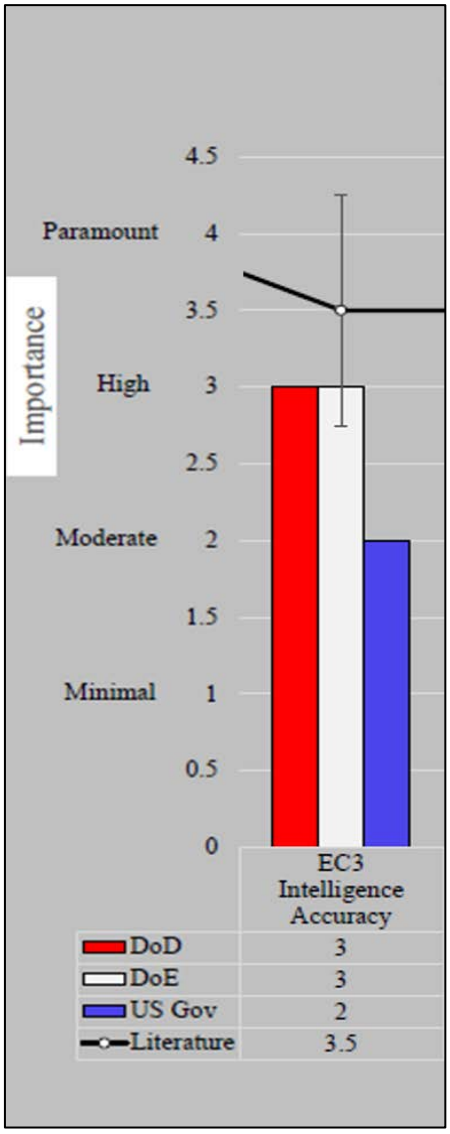


Figure 18. Behavioral Influence Assessment (Sandia National Laboratory, 2016)



The Literature review consistently listed intelligence accuracy between highly important and of utmost paramount importance. For that reason the Literature Review Score assigned by this study is a '3.5'. The score is depicted on the left in Figure 19.

The error bar in Figure 19 reflects a 0.75 deviation from '3.5'. The responses from both DoD and DoE fell within a reasonable score based on the literature. However, U.S. Government officials only scored intelligence accuracy as a '2'.

Survey participants responded to the question of the USAF ability to enable escalation control as determined by the number of respondents that report accurate intelligence such as an adversary behavior model enables escalation control.

Figure 19. EC3- Intel Accuracy

DoD and DoE both scored the USAF as a '3' in EC3. However, they offered strikingly differing perception during the interview. DoD respondents viewed intelligence as being utilized primarily to assess the adversary military strengths, weaknesses, capabilities, and quantities. DoE offered a vastly different perception- that intelligence is utilized to understand how an adversary will behave given a specific stimulation.

Figure 20 below provides the breakout of answers based on the following available responses:

0. Unknown
1. Minimal
2. Moderate
3. High
4. Paramount

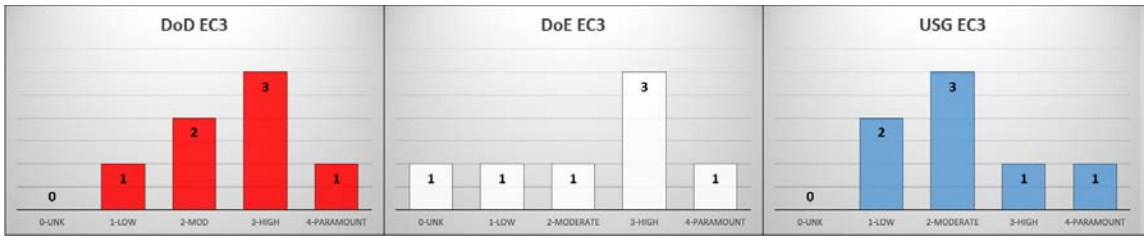


Figure 20. EC3: Intelligence Accuracy (Interview Responses)

This study concludes that the USAF can improve its intelligence operations regarding escalation control. This study is not referencing the USAF's ability to conduct Intelligence, Surveillance, and Reconnaissance (ISR). Instead, the DoD responses offered 'high' scoring, but for the wrong reasons.

No respondents offered that the USAF is adequately assessing potential adversary behavior. It was DoE that offered the criticism that the USAF is not fully utilizing adversary behavior models that are currently available. Current USAF assessments center on military fielded forces, not leadership behavior. This difference of viewpoint will be expanded on in EC4.

> *"…Current USAF assessments center on military fielded forces, not leadership behavior. These products are currently available in DoE. The real challenge is establishing what risk or cost is deemed unacceptable for your adversary. This can differ vastly between countries, and can even change for a specific leader day-to-day, depending on the situation."*

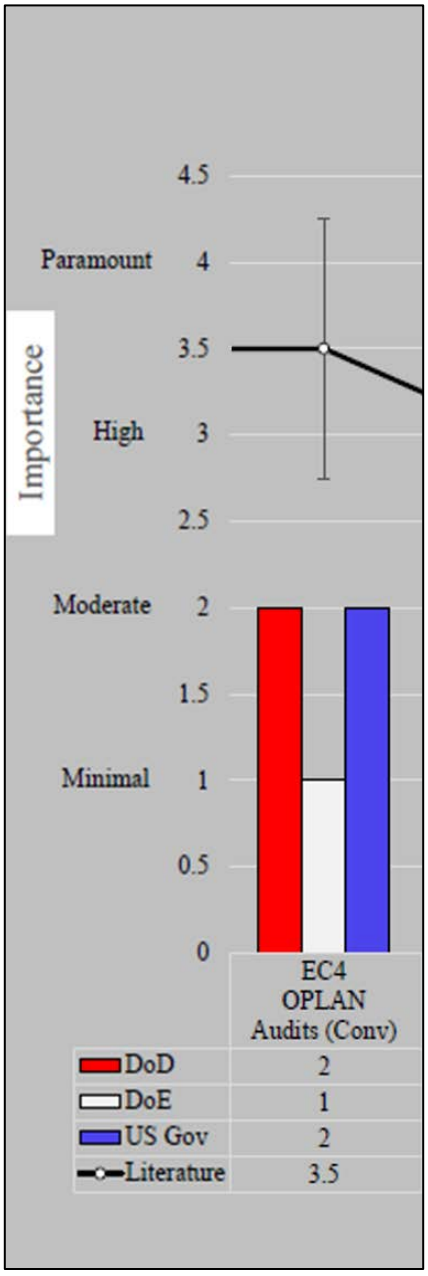
EC4: Audit Conventional OPLANs (Detecting Nuclear Thresholds)

There are multiple dangers regarding nuclear thresholds that might not be honored by USAF conventional strategists and planners addressing USAF strike options against real world adversaries that poses nuclear weapons. EC4 was determined by the literature and is best described as how the USAF audits conventional OPLANs for inadvertently planning airstrikes that would cross an adversary's nuclear threshold, thus resulting in a nuclear retaliation. In short, this study aimed to assess how well the USAF establishes 'red-lines' around allied operations in a conventional conflict. Escalation control principle 4 is an evolving process, meaning that an accurate assessment today may become obsolete tomorrow.

According to a 1982 MIT Press article, inadvertent escalation is a consequence of conventional military practices and is affected by choices regarding force posturing, operational planning, and inconsiderate targeting (Posen, 1982). In other words, conventional war plans may exist that inadvertently cross nuclear thresholds.

This escalation control principle includes two primary research items used to engage with respondents during face-to-face interviews. First, how well does the USAF continue to monitor adversaries for the potential shift in thresholds, and second, how well does the USAF disseminate shifting thresholds to affected decision makers, strategists, and planners? The results are depicted in Figure 21.

Twenty one survey participants, seven from DoD, seven from DoE, and seven from the U.S. Government, responded to the question regarding the USAF ability to enable escalation control in the area of EC4.



The Literature Review Score for EC4 was determined between '4' and '3', and was conservatively scored as a '3.5' by the researcher. The error bar represents a 0.75 margin of error for EC4. Responses from the whole of government perspective all indicate that the USAF fails to place appropriate priority on auditing conventional war plans for potential nuclear escalation thresholds.

All three areas of research respondents scored the USAF auditing for thresholds as sharply below appropriate levels. DoD senior leaders and U.S. Government officials associated with the House and Senate Armed Services Committee (HASC/SASC) indicated that the USAF places a moderate emphasis on auditing conventional plans. DoE respondents placed an even lower assessment of '2-minimal' regarding perceived USAF auditing procedures and dissemination responsiveness.

Figure 21. EC4- Audit Plans

The implications of this finding are important and may shape the entire process of USAF conventional operations around the world. Figure 22 is a detailed depiction of the number of respondents that report conventional war plans should be reviewed to ensure nuclear thresholds of the adversary are not crossed.

Figure 22 below provides the breakout of responses based on the following available responses:

0. Unknown
1. Minimal
2. Moderate
3. High
4. Paramount

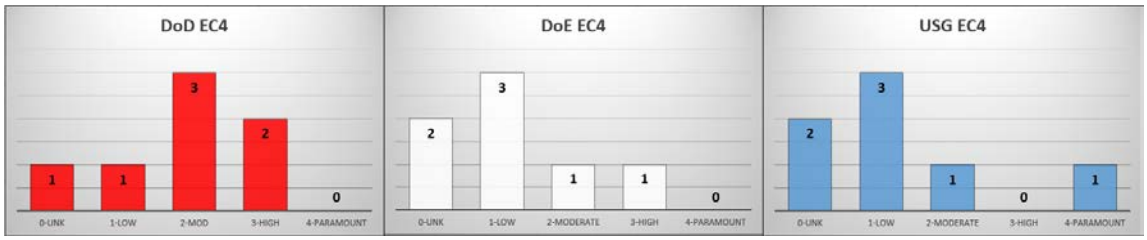


Figure 22. EC4 Audit Conventional OPLANs (Interview Responses)

There are numerous examples of inaccurate or incomplete understanding by policy-makers of ongoing military operations (Posen, 1982: 34). History provides insight into why differences might occur between the literature and the respondents. A majority of literature involving EC4 predominately centers on a timeframe form 1980 to 1992, during the final stages of the Cold War. Nuclear thresholds were a clear and present danger for conventional planners at that time, more so than they are today (Kroenig, 2017). The following is a quote from a HASC staff member.

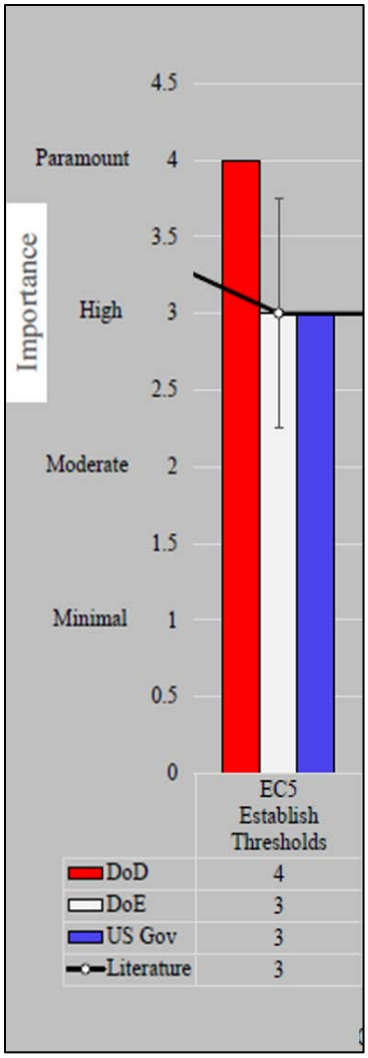
> *"…Current conventional planners are not privy to USSTRATCOM intelligence and assumptions for an adversary's nuclear thresholds. This is primarily due to geographic separation, classification, and current need-to-know criteria. I fear that there are conventional plans on the shelf right now that immediately cross an adversary's nuclear threshold. Great caution and prudence should be taken to resolve this issue as quickly as possible."*

EC5: Establish Escalation Thresholds (Full Spectrum Milestones)

Establishing thresholds is also a foundational aspect of escalation control. According to the literature, there must be a balance between transparency and ambiguity when signaling an adversary and establishing thresholds. The form of signaling addressed in this section is, specifically, the establishment of thresholds before conflict begins.

According to the literature there are two primary aspects for establishing thresholds. The first is within internal channels, which would include decisions by policy makers and strategists amongst domestic and allied audiences. The second aspect, once internal thresholds are established, is to communicate those thresholds to the adversary.

In most cases there are globally recognized thresholds. For example, the first exchange of hostile fire resulting in a casualty by either side is widely accepted as a threshold or milestone. In this example the milestone is a significant act or event which resulted in the loss of life. Diplomatically establishing the thresholds with a potential adversary is a challenging aspect of deterrence and escalation control (Kilgour and Zagare, 2007).



The literature review consistently listed establishing thresholds as highly important. Therefore, a Literature Review Score of '3-High' is assigned to EC5. The error bar in Figure 23 represents a 0.75 error.

DoD responses indicate the USAF enables paramount levels of EC5. Both DoE and U.S. Government responses score the USAF at '3' for enabling the establishment of thresholds. All three areas of respondents indicate the USAF meets or exceeds the literature expectations for EC5.

Analysis of EC5 in Figure 23 offers that the DoD perception of USAF enabling EC5 actually exceeds the literature expectations. This is due to two factors. First, the strict coherence of military commanders to Presidential directives increases the credibility of response.

Figure 23. EC5- Thresholds

Secondly, the nature of the capabilities that the USAF offers provide pre-conflict credibility. For example, Inter-Continental Ballistic Missiles (ICBM), nuclear capable stealth bombers, and dominant stealth fighters all lend to diplomatic credibility in signaling an adversary.

Figure 24 below provides the breakout of responses based on the following available responses:

0. Unknown
1. Minimal
2. Moderate
3. High
4. Paramount

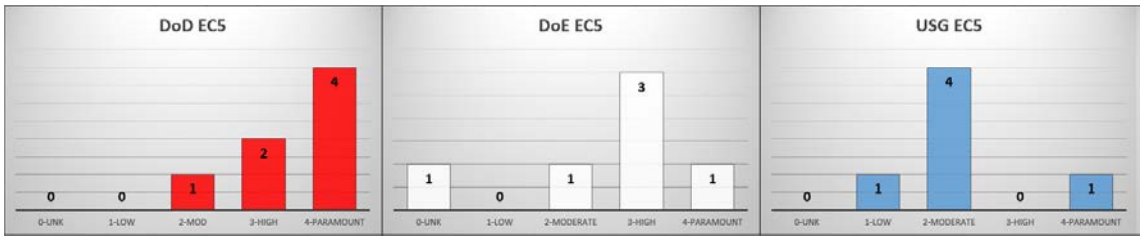


Figure 24. EC5: Establishing Escalation Thresholds (Interview Responses)

The consequence of over-transparency is that the adversary will immediately understand, with high confidence, the boundaries of maneuver. This can lead to provocative behavior such as insidious infractions to probe for responses in order to confirm thresholds and test resolve. On the other hand, overly opaque thresholds may lead to inadvertent escalation due to an adversary unknowingly crossing a threshold. Discussion on establishing thresholds can be summarized by one HASC/SASC response.

> *"…one of the most prevalent concepts of escalation control is establishing mutual thresholds for conflict. Each of these escalation thresholds should be coupled with an opportunity to de-escalate, or off-ramp. It is not the USAF's role to negotiate these off-ramps. However, it is definitely the USAF's role to make continued conflict and escalation an option that the adversary does not desire. This can be done through a combination of capability and credibility."*

EC6-10: USAF Effectiveness Across Remaining Principles

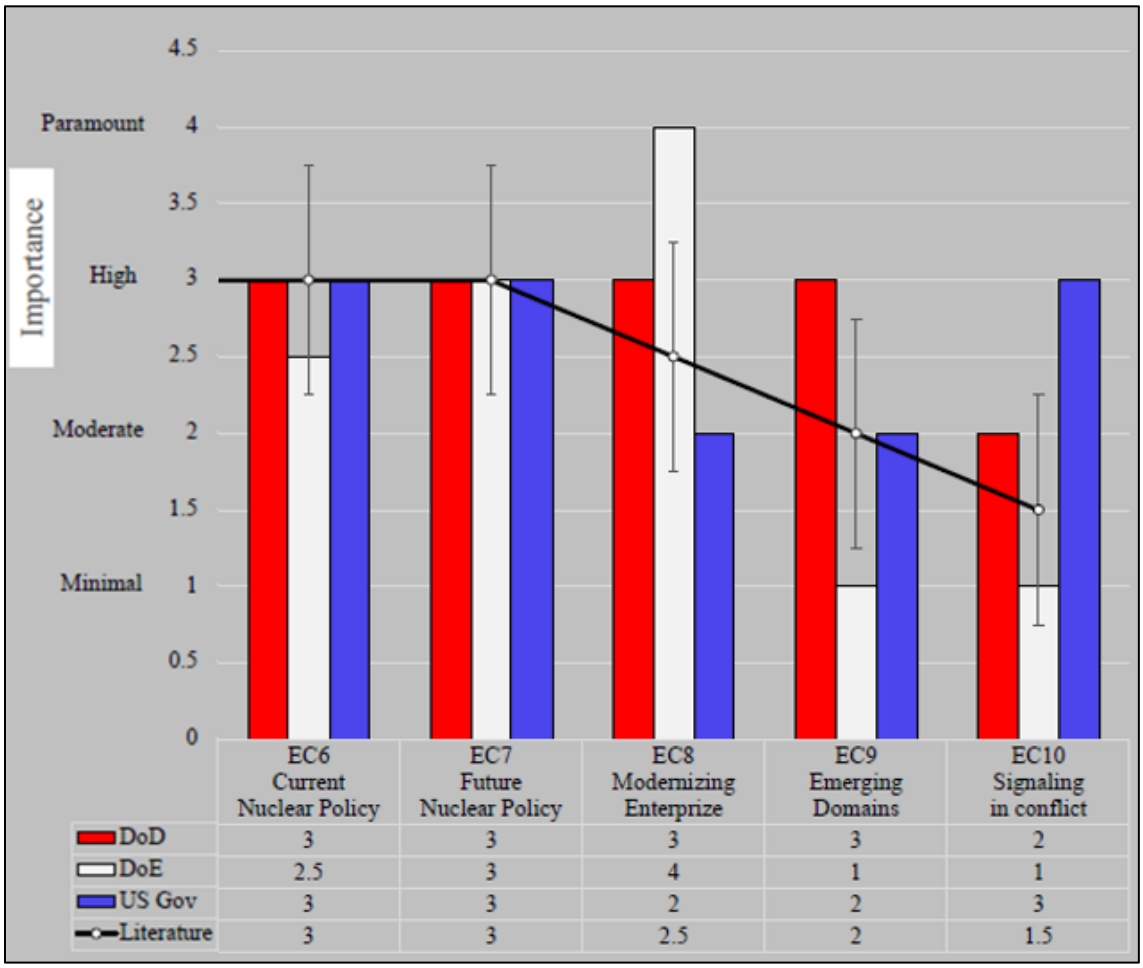


Figure 25. EC6-10: USAF Escalation Control Principles

A detailed study of escalation control principles 6 through 10 resulted in relatively insignificant findings compared to principles 1-5. However, one objective of this study is to publish and briefly discuss the top ten principles of escalation control. Therefore, the purpose of this section is to briefly review the data, analysis, and results of EC 6-10. Each principle will be discussed regarding literature review findings and interview response highlights.

EC6 – Current Nuclear Deterrence Policy

Escalation control principle 6 is focused on current nuclear deterrence policy and the subsequent interaction with the USAF. Current nuclear deterrence policy is of high important for establishing escalation control. Without established policy there would be much difficulty for diplomats and commanders to maneuver in a cohesive manner.

The primary method that the U.S. accomplishes EC6 is through publishing unclassified Nuclear Posture Review (NPR) and subsequent Quadrennial Defense Review (QDR). These two documents drive the details of classified DoD and USAF guidance. This deterrence policy and guidance serves as the backbone for establishing priorities for resource allocation, training, readiness, and posturing of USAF capabilities and war plans.

> *"…our current nuclear deterrence policies are underpinned by the 2010 Nuclear Posture Review (NPR). However, much has changed since 2010. These changes include a resurgent Russia, emerging Chinese and North Korean capabilities, and an aspiring Iran. Our current resourcing priorities must fall in line with declared Joint and USAF policy."*

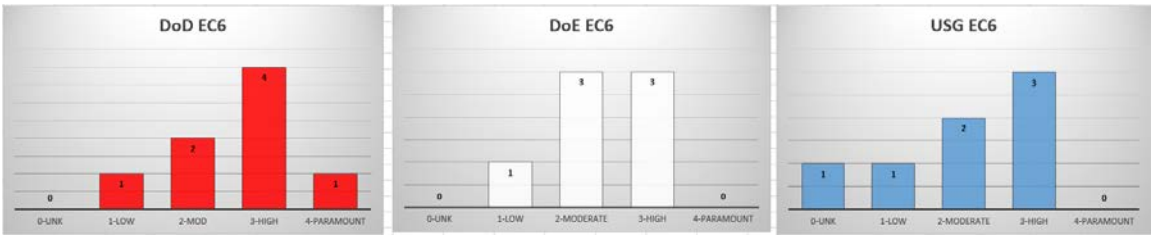


Figure 26. EC6: Current Nuclear Policy (Interview Responses)

Survey responses from all three respondent groups are consistent with the literature. The DoE respondents evenly scored the USAF '2' and '3' respectively.

EC7 – Future Nuclear Deterrence Policy

The literature establishes future nuclear deterrence and escalation control policy as highly important. This ever-evolving aspect of deterrence policy provides a viable mechanism for military leaders and government officials to resolve current policy and resource shortfalls.

The 2010 Nuclear Posture Review (NPR) is being rewritten. According to 5 of the 7 respondents, Air Force Doctrine derived from NPR and subsequent QDR should consider Escalation Control guidance as a direct function of the Joint Forces Air Component Commander (JFACC). The following quote accurately summarizes the interview responses.

> *"…President Trump has directed a Nuclear Posture Review. This is important because it invokes a full spectrum assessment and reporting of the future state of nuclear deterrence affairs across the world."*

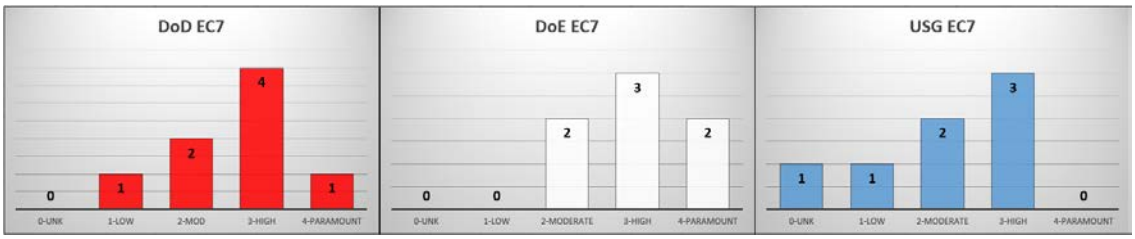


Figure 27. EC7: Future Nuclear Policy (Interview Responses)

EC7 is the only escalation control principle that all four aspects studied scored the same. The literature, DoD, DoE, and U.S. Government responses all scored future nuclear policy as '3-High'.

EC8 – Modernizing the Nuclear Enterprise

EC8 focuses on modernizing the nuclear enterprise. EC8 is a consistent topic in the literature and scores as moderately important as an aspect of escalation control. Modernization within the USAF directly supporting escalation control include the following weapon systems.

1. B-61 nuclear weapon modification
2. B-21 bomber acquisition
3. Long Range Stand Off (LRSO) cruise missile initiative
4. Service Life Extension Program (SLEP) for Minuteman Inter-Continental Ballistic Missile (ICBM)
5. National Command, Control, and Communication (NC3) initiative

"…this NPR will be paramount in establishing deterrence policy towards Russia, China, North Korea, and Iran. From this NPR the USAF will hopefully be able continue to advocate for resources to modernize strategic conventional and nuclear forces."

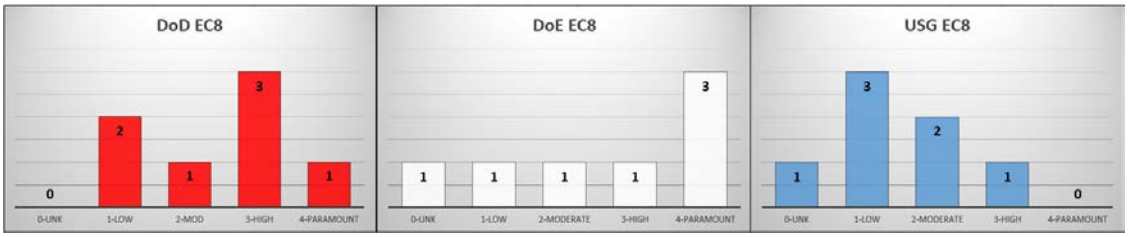


Figure 28. EC8: Modernizing Nuclear Enterprise (Interview Responses)

Figure 28 provides the breakout of responses. Two important insights were derived from interview responses. First, the DoE considers modernization efforts to be of

paramount importance. This DoE sensitivity to technological advancement is logically explained by the large responsibility the DoE bears in support of EC8.

Secondly, the U.S. Government responses offered modernization as a low priority. The primary reason for this is due to the broad range of topics that elected and appointed government officials must face. Health care, immigration, tax reform, and upcoming elections are just a few examples of topics that government officials handle on a day-to-day basis. When the topic of modernization of the nuclear enterprise is breached, elected officials rely heavily on HASC and SASC members for focused input.

Current modernization efforts within the USAF are costly, but modernization establishes a longevity of dominance regarding the balance of power. Modernization efforts tie back into EC1 and EC2 in that, once complete, they will re-establish conventional dominance and an even more secure second strike ability.

Modernization of the nuclear enterprise is a very costly aspect of deterrence, and is therefore a highly scrutinized aspect of DoD efforts. However, scrutiny should not be interpreted as negativity. In fact, prudent understanding of the cost breakout and the negative implications for failure to modernize is considered a healthy aspect of a 'whole of government' approach to deterrence. A modernization regime that is coherent with current and emerging policy will always be audited for financial stewardship. The USAF role is to be sufficiently postured to equip decision makers with accurate cost and impact details for each weapon system. Modernizing, through advocacy, is a way that the USAF can continue to support national security objectives addresses current and future shortfalls.

EC9 – Emerging Deterrence Domains

Escalation control principle 9 is focused on emerging domains within the spectrum of conflict. There are several emerging domains that are beginning to affect USAF escalation control effectiveness. An emerging domain is an area of potential conflict that has not been historically utilized during armed conflict (Lin, 2007). Current security planners in the US have become increasingly concerned that multi-domain engagement poses the greatest risk to US national security.

Security planners are currently frustrated attempting to establish clear multi-domain conflict thresholds, especially the first few thresholds that do not include kinetic hostilities. This is known as Cross-Domain Operations (CDO). These CDO thresholds have two main forms, non-kinetic escalation and non-kinetic-to-kinetic escalation.

Cyber escalation is a good example of CDO potential. Cyber escalation is defined as how the initial stages of conflict in cyberspace might evolve and escalate (Lin, 2007). One of the most difficult aspects of the cyber domain is establishing internationally recognized normative behavior. This lack of international agreement in cyberspace does complicate the establishment of mutually understood thresholds, thus complicating cyber escalation control.

Cyber-to-kinetic escalation is an evolving study of nuclear deterrence that offers policy makers and military leaders many challenges. Accurate attribution of a hostile cyber attack remains the most significant challenge. Secondly, educating policy makers and military leaders on cyber capabilities is difficult due to the classification of most cyber systems. Geographic decentralization of cyber operations poses a challenge to continuity of operations.

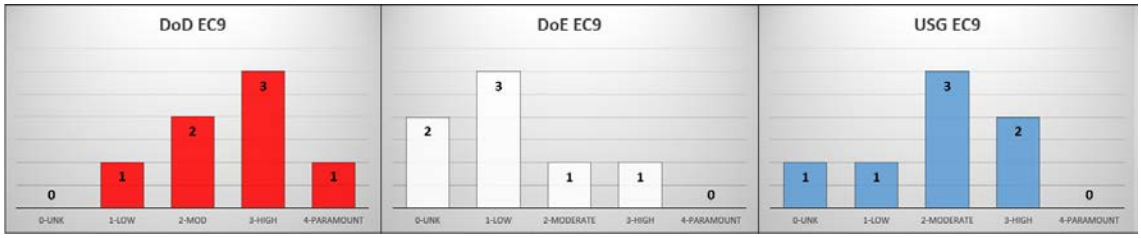


Figure 29. EC9: Emerging Domains (Interview Responses)

The Literature Review Score establishes EC9 as a '2-moderate' importance. DoD, DoE, and US Government officials did not respond harmoniously regarding emerging domains. This can be troublesome for establishing future escalation policy for CDO.

This research also encountered very encouraging information during a Cross-Domain Deterrence conference held at DoE. During this conference it was agreed that overcoming classification and separation is possible. To do this cyber operators can equate highly capabilities to easily understood terms without disclosing actual cyber tradecraft. Examples of such metaphorical terms return battlefield commanders to non-cyber mindset. An example such terminology include cyber-pistol, cyber-rifle, cyber-grenades, and other metaphorical terms with increasing intensity all the way up to 'cyber-nukes.'

"…Establishing effective policy for emerging domains remains a challenge due to security classification and decentralized nature of CDO. Instead of talking to a four-star general about bits and bots, use terms like bullets and bombs to represent capability. This reduces security concerns and gets the conversation back to strategic decision making."

EC10 – Signaling During Conflict

Escalation Control principle 10 is focused on the importance of intra-conflict signaling by the USAF. Survey participants responded to the question of the USAF ability to enable escalation control as determined by the number of respondents that report conventional dominance will deter hostilities.

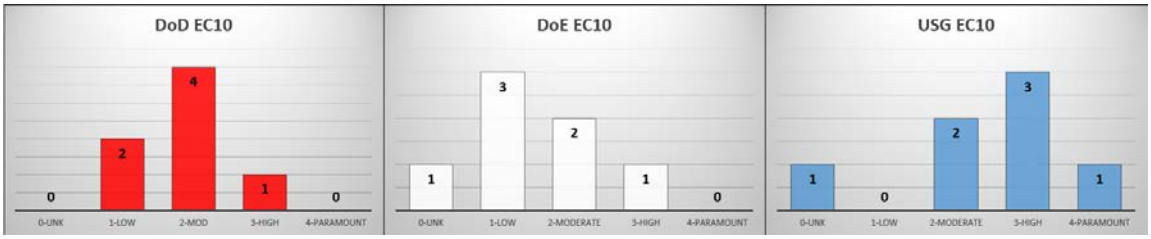


Figure 30. EC10: Signaling During Conflict (Interview Responses)

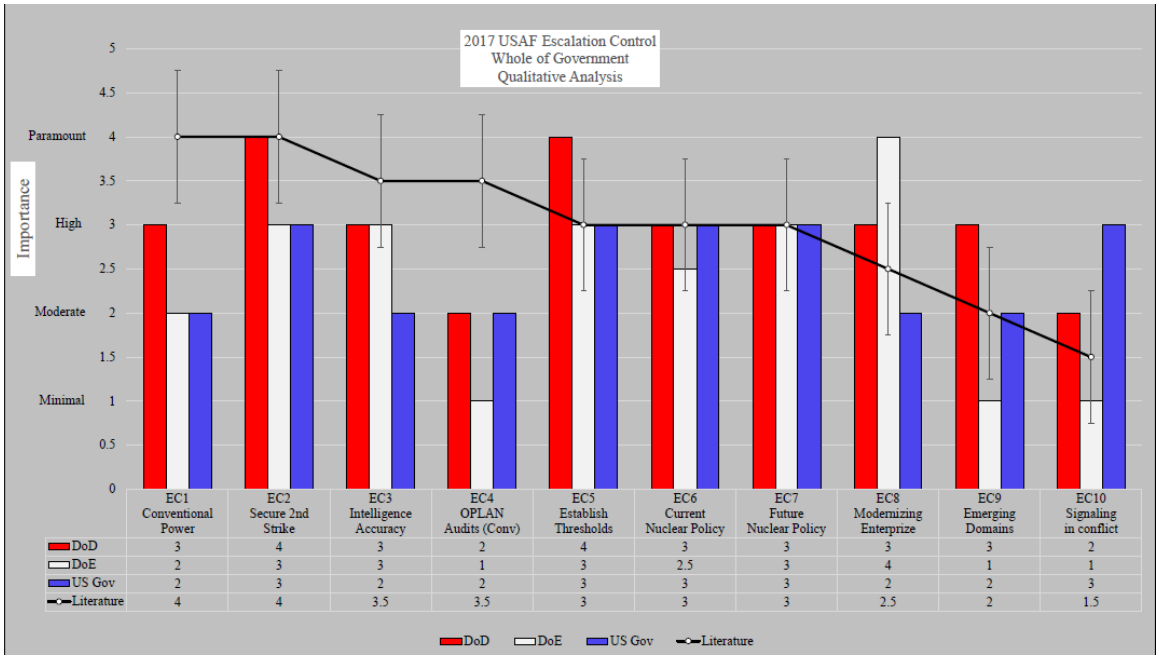
The Literature Review Score for EC 10 was determined to be '1.5'. This is due to the vast amount of literature available that debunks the concept that signaling is effective once conflict has begun. Interview responses from across the whole of government were not consistent with each other.

One respondent replied,

> *"…once a conflict begins there is a reduced effectiveness of messaging and signaling. This can be the result of physical attacks on communication infrastructure, disconnected timelines between signal and action, and even cultural and language barriers. It is therefore best to establish thresholds and milestones prior to the onset of hostile engagements."*

V. CONCLUSION & RECOMMENDATIONS

Figure 31 below is a summary of the results of this mixed method study of how to modernize USAF escalation control. A literature review was accomplished that spanned 1945-2017 searching for common principles to escalation control. The most predominant theoretical aspect to escalation control was establishing thresholds that are mutually understood between adversaries. Twenty one interviews with participants from across the whole of government were scored on a scale of 0-4. Responses from the whole of government interviews were compiled into a graphic to ascertain the USAF effectiveness in each of the ten principles of escalation control.



	EC1 Conventional Power	EC2 Secure 2nd Strike	EC3 Intelligence Accuracy	EC4 OPLAN Audits (Conv)	EC5 Establish Thresholds	EC6 Current Nuclear Policy	EC7 Future Nuclear Policy	EC8 Modernizing Enterprize	EC9 Emerging Domains	EC10 Signaling in conflict
DoD	3	4	3	2	4	3	3	3	3	2
DoE	2	3	3	1	3	2.5	3	4	1	1
US Gov	2	3	2	2	3	3	3	2	2	3
Literature	4	4	3.5	3.5	3	3	3	2.5	2	1.5

Figure 31. 2017 USAF Escalation Control Analysis

The graphic was used to compare the literature review importance against the USAF performance, specifically searching for major disparities in scores. EC1-4 were found to have significant differences, indicating potential improvement areas for the

USAF. EC 5-7 demonstrated significant correspondence between the literature and the interview responses. Finally, EC 8-10 indicated relatively reduced implication for escalation control effectiveness of the USAF.

The most significant finding of this research pertains to EC4- Auditing Conventional OPLANs. Simply put, there might currently be a conventional war plan that inadvertently crosses an adversary's nuclear threshold. Ascertaining current thresholds and accurately disseminating these triggers to planners is challenged by classification and geographic decentralization. For example, USSTRATCOM might be hindered from disseminating new thresholds to conventional planners in Europe or Pacific areas due to geographic separation and classification issues.

The largest financial impact of any of the escalation control principles pertains to EC8: Modernizing the Nuclear Enterprise. Current budgetary estimate place modernization costs at $1 Trillion dollars over the next thirty years. To be effective, EC8 must correctly incorporate all aspects of EC1-7. This holistic approach to ICBM, bomber, cruise missile, and even conventional stealth fighter development is a demonstration of the whole of government approach to deterrence.

The research finding that impacts the greatest audience across the whole of government is EC3: Intelligence Accuracy. The most prevalent aspect of EC3 discovered during this research is the disparity between DoE intelligence expectations and DoD intel expectations. DoE asserts that adversary behavior should be incorporated into intelligence discussions, and has worked diligently to establish credible adversary behavior models. DoD, on the other hand, asserts that the USAF remains effective at traditional ISR operations to feed a commanders intel picture comprised of military data such as capability,

quantity, location, strengths, and weaknesses. Vast capital is expended in order to keep intelligence as accurate as possible. Any opportunity for DoD and DoE to share intelligence requirements and products is advisable. However, intelligence is never perfectly accurate, so leaders and strategists in the nuclear deterrence domain are cautioned not to place too much emphasis on any one product or source.

The research discovered EC9: Emerging Domains can be tied back into EC1 and EC2. The arena of battle is shifting during Cross Domain Deterrence and Escalation Control. This is complicated by highly classified cyber capabilities and the decentralize nature of cyber operations. However, when tied back into EC1 and EC2 there is a more important aspect to consider- dominance. Escalation control is best enabled as long as the USAF can advocate to maintain dominance in any and all domains.

Finally, almost every principle in the study can be directly tied back into a dominant balance of power. This is regardless of the type of power such as conventional, nuclear, cyber, economic, diplomatic, etc.

Recommendations for Action

The following are the top recommendations derived from this study. The areas of improvement recommended by this research include building more confidence in adversary behavior modeling, auditing conventional plans for adversary nuclear thresholds, and finally the introduction of nuclear escalation control objectives into conventional Mission Type Orders (MTO). Implications of these recommendations are as follows;

1) Prevent adversary incentives for escalation above nuclear thresholds by dominating the balance of conventional power by the USAF.

2) Prevent adversary incentives for escalation above nuclear thresholds through an assured second strike retaliation by the USAF.

3) Prevent adversary incentives for escalation above nuclear thresholds by improved understanding of adversary perception of USAF using available adversary behavior models.

4) Prevent adversary incentives for escalation above nuclear thresholds by ascertaining adversary thresholds that would trigger a nuclear response, followed by an audit of conventional OPLANs and strike options to ensure threshold are not inadvertently crossed.

Recommendation 1

This research uncovered a disparity between DoE and DoD perception of appropriate intelligence analysis. DoD responses stated that the USAF utilizes intelligence to assess battlefield components for information such as quantity, type, and location. DoE responses stated that the USAF should also incorporate adversary behavior models. Understanding the adversary perception and risk adversity will increase USAF decision maker fidelity in a complex environment.

The DoE currently works closely with all aspects of the Intelligence Community (IC) to create and maintain adversary behavior models. However, these models are resource intensive and are tailored for specific customers. Therefore, it is recommended that future research be conducted to ascertain the compatibility of DoD and DoE requirements, capability, and utilization of adversary behavior models. This research would most likely be accomplished at the classified level, and may require research funding to support DoE participation.

Recommendation 2

This research exposed the potential for current conventional air campaigns to inadvertently cross an adversary's threshold, resulting in a nuclear retaliation on US or allied forces. Since the Cold War the USAF has enjoyed a conventional dominance and relatively unopposed air operations over Iraq and Afghanistan. Successful air-to-ground targeting campaigns during the Gulf Wars and counter-terrorism activities in the Middle East have anesthetized strategists and planners to adversary nuclear thresholds. The literature offers many examples where a superior conventional force or an overwhelmingly desperate situation may force a weaker adversary to utilize a nuclear weapon in order to rebalance the situation.

Therefore, it is recommended that the USAF immediately assess current OPLANs and air-to-ground strike options to ensure an adversary's nuclear thresholds are not inadvertently crossed. The underlying issue with adversary thresholds is not obtaining the information regarding an adversary threshold, assuming the requestor has a security clearance. However, the true challenge lies in swift dissemination from the IC to policy makers, strategists, and planners that are geographically separated from the intel source.

It is recommended that future research be conducted to ascertain current air campaign plans to ensure they do not inadvertently cross adversary nuclear thresholds. This research would most likely require a researcher that is well versed in air-to-ground operations at the tactical and operational level. This research would most likely be required to be accomplished at the classified level, and may require research funding to enable face-to-face researcher interaction with the intelligence community.

Recommendation 3

Therefore, it is recommended that Joint Forces Air Component Commanders (JFACC) include an escalation control objective into their published Mission Type Orders (MTO). Mission Type Orders are standardized products that are used to quickly disseminate JFACC intent, acceptable level of risk, and objective for each operation. These MTO documents are utilized by strategists and planners at the operational and tactical level to focus resources on mission success according to the vision and direction of the JFACC.

This research discovered that no current guidance exists to direct current USAF operations and intelligence personnel to monitor current and potential adversary nuclear thresholds. More specifically, the USAF Intelligence Community lacks guidance from DoD leadership defining what information is required to refine policy and strategy. Geographic separation and classification barriers also hinder efficient assessment and dissemination of intelligence products.

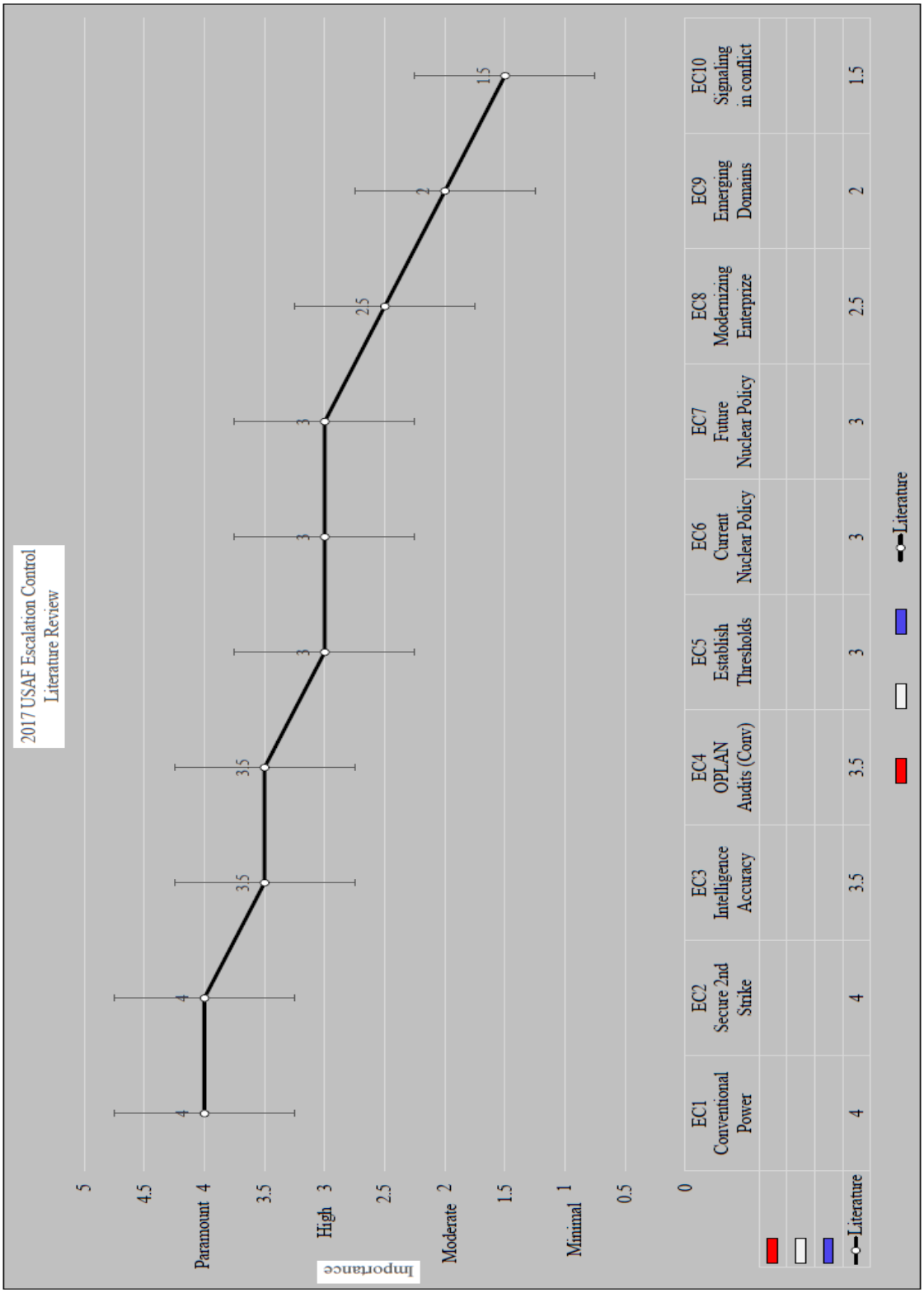
Summary

The USAF will have successfully modernized escalation control when a JFACC publishes an escalation control objective into MTO because a behavior model of the adversary raised concern that a conventional USAF operation may cross a nuclear threshold.

Appendix A. Interview Questionnaire

IQ1: Establishing current state of USAF effectiveness at Escalation Control					
"Based on your expertise or observation, what currently makes the USAF effective at Escalation Control?"					
Note: Options below are from literature and **NOT** made available to respondants in order to avoid tampering response.					
IQ2: Determine if anything new is modifying Nuclear Deterrence/ Escalation Control					
"Based on your expertise or observation, what emerging dynamics are beginning to affect Escalation Control?"					
Note: Options below are from literature and **NOT** made available to respondants in order to avoid tampering response.					
IQ3: Establishing improvement areas for USAF Escalation Control					
"Based on your expertise or observation, how can the USAF improve Escalation Control?"					
Note: Options below are from literature and **NOT** made available to respondants in order to avoid tampering response.					
EC1	Balance of Conventional Power (Credible Conventional Deterrent)				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC2	Secure Second Strike (Credible Nuclear Deterrent)				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC3	Intelligence Accuracy / Adversary Behavior Modeling				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC4	Auditing Conventional OPLANs & Strike Options				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC5	Establishing Thresholds (Escalation Milestones)				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC6	Current Nuclear Deterrence Policy				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC7	Future Nuclear Deterrence Policy				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC8	Modernizing Nuclear Enterprize (B-21, B-61, LRSO, SLEP)				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC9	Emerging Domains (Space, Cyber, Hybrid, Grey-zone)				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
EC10	Signaling Effectiveness once Conflict Begins				
	0. Unknown	1. Minimal	2. Moderate	3. High	4. Paramount
Notes and Quotes:					

Appendix B. 2017 USAF Escalation Control Literature Review

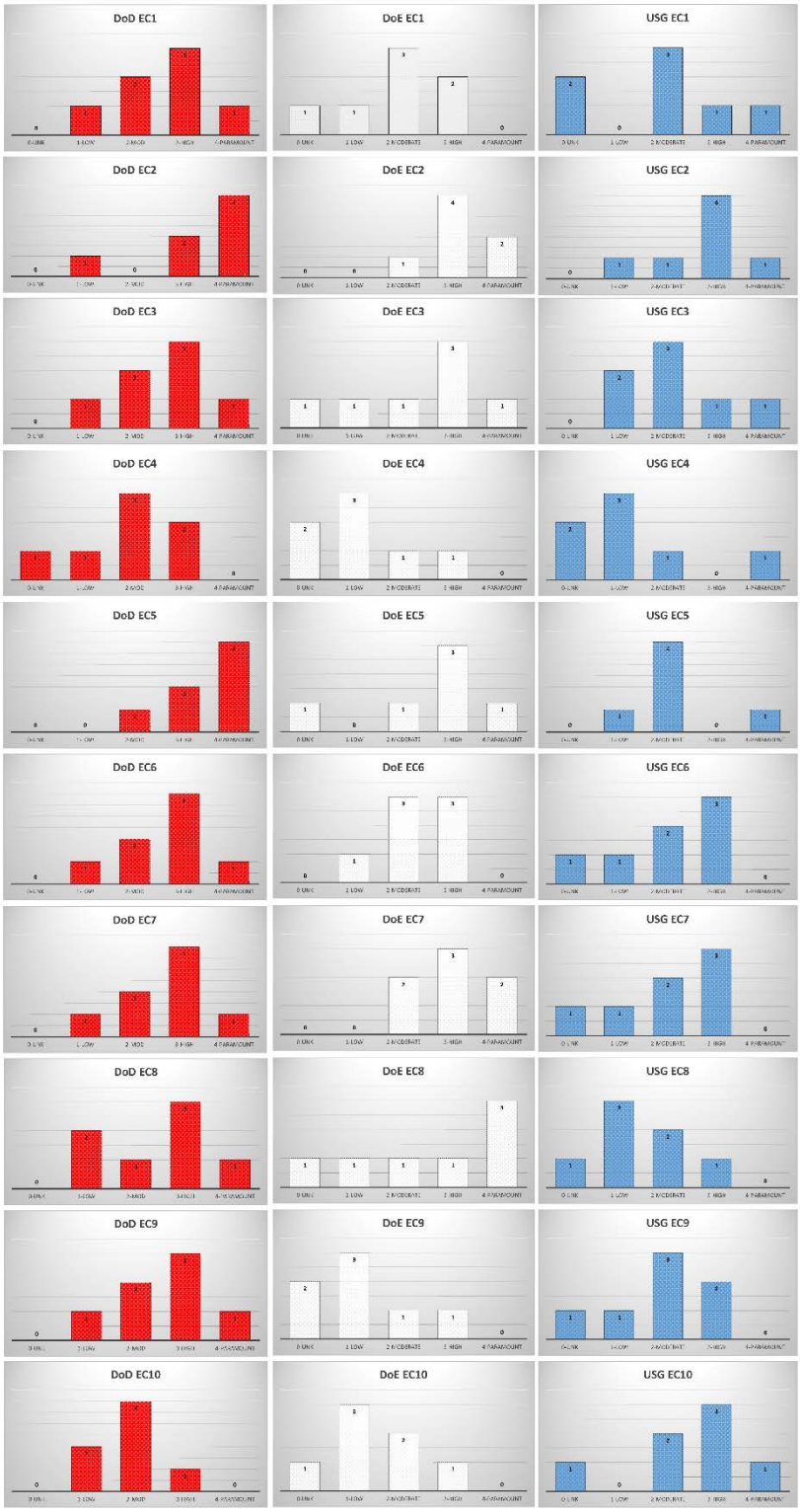


Appendix C. 2017 USAF Escalation Control Interview Analysis

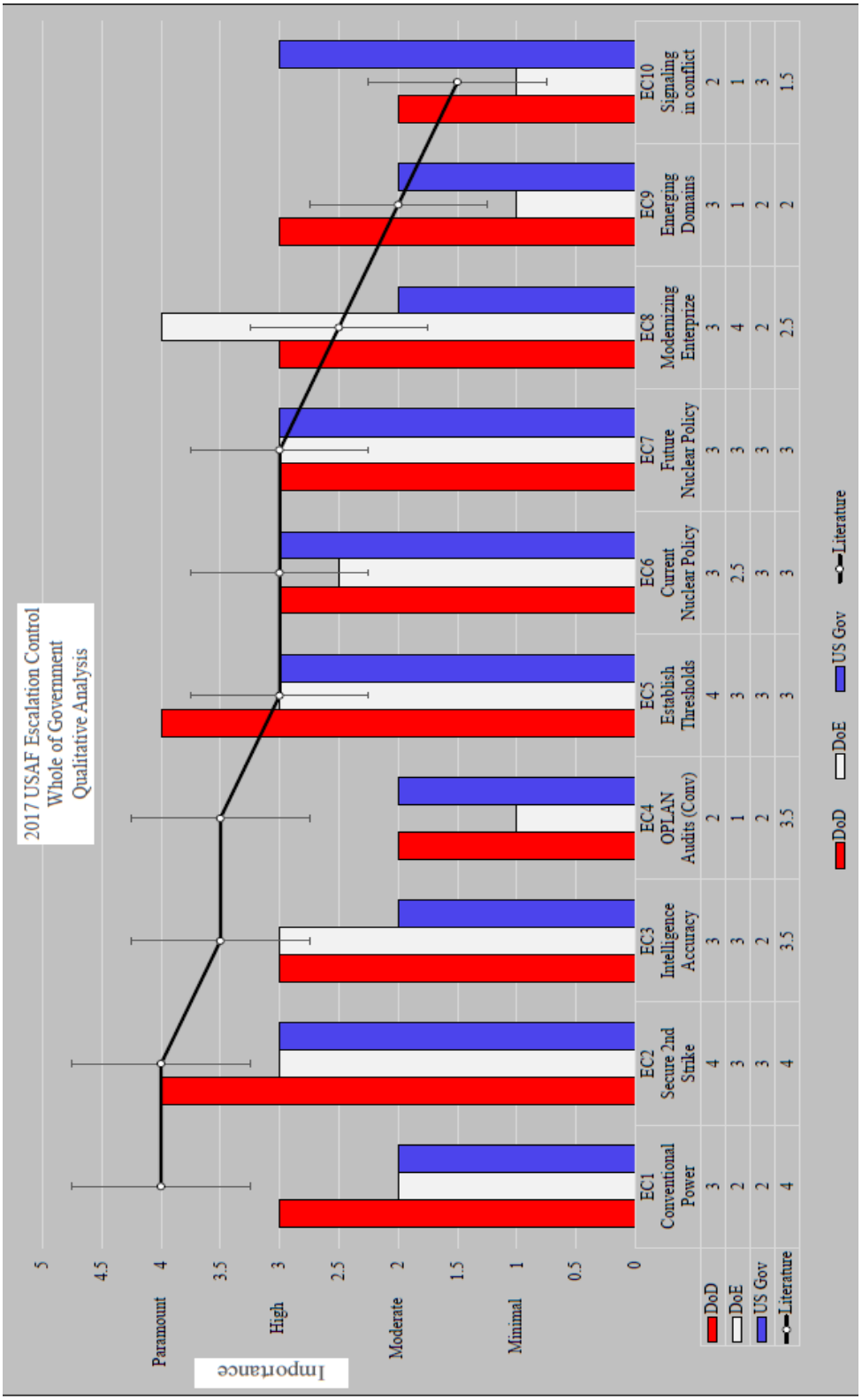
	0-Unc	1-Low	2-Mod	3-High	4-Paramount
DoD EC1	0	1	2	3	1
DoD EC2	0	1	0	2	4
DoD EC3	0	1	2	3	1
DoD EC4	1	1	3	2	0
DoD EC5	0	0	1	2	4
DoD EC6	1	1	2	3	0
DoD EC7	0	1	2	3	1
DoD EC8	0	2	1	3	1
DoD EC9	0	1	2	3	1
DoD EC10	0	2	3	1	0

	0-Unc	1-Low	2-Moderate	3-High	4-Paramount
DoE EC1	1	1	3	2	0
DoE EC2	0	0	1	3	2
DoE EC3	1	1	1	4	1
DoE EC4	2	3	1	1	0
DoE EC5	1	0	1	3	1
DoE EC6	0	1	3	3	0
DoE EC7	0	0	2	3	2
DoE EC8	1	1	1	1	3
DoE EC9	2	3	1	1	0
DoE EC10	1	3	2	1	0

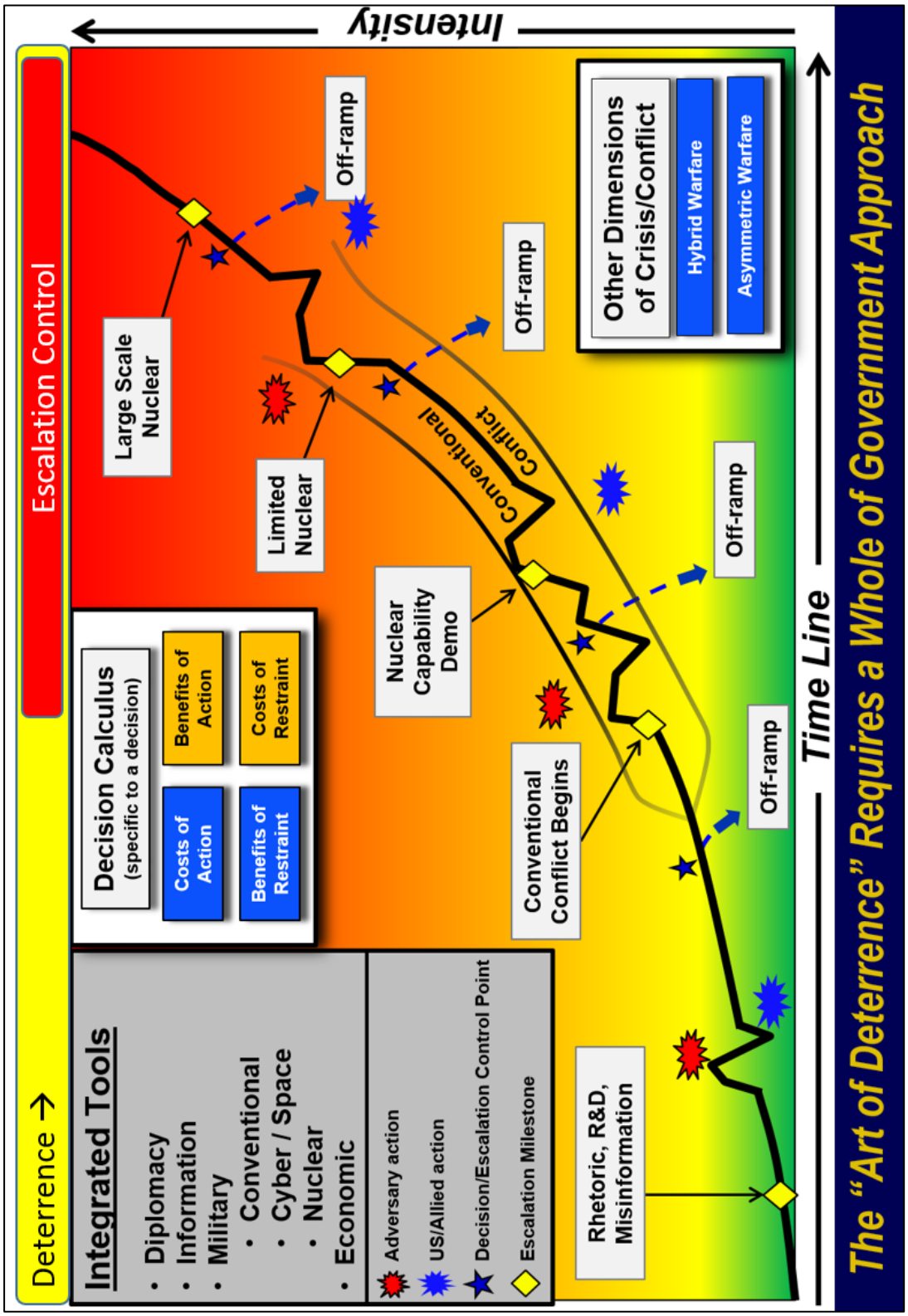
	0-Unc	1-Low	2-Moderate	3-High	4-Paramount
USG EC1	2	0	3	1	1
USG EC2	0	1	1	4	1
USG EC3	0	2	3	1	1
USG EC4	2	3	1	0	1
USG EC5	0	1	4	0	1
USG EC6	1	1	2	3	0
USG EC7	1	1	2	4	0
USG EC8	1	3	2	1	0
USG EC9	1	1	3	2	0
USG EC10	1	0	2	3	1



Appendix D. 2017 USAF Escalation Control Comparative Analysis



Appendix E. Modern Deterrence & Escalation Control (USSTRATOM, 2016)



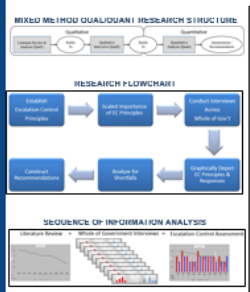
Modernizing United States Air Force Escalation Control

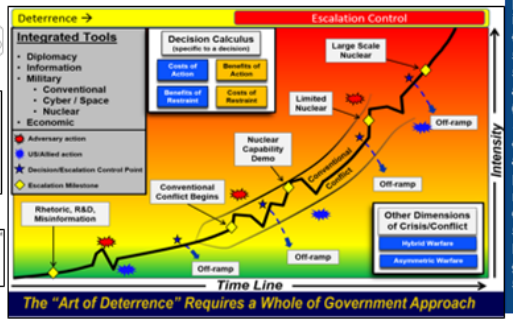
How can the USAF operationalize the theoretical aspects of escalation control in order to provide means by which off-ramps are made attractive to an adversary?

Maj Justin "HOOKER" Gamel
Advisor: Maj Heidi M. Tucholski, PhD
Advanced Nuclear Deterrence Studies (ENS)
Air Force Institute of Technology

Abstract

This Graduate Research Project (GRP) will assess how the United States Air Force (USAF) can implement escalation control operations. Escalation control theory models were once capable of predicting escalation with an accuracy up to 98%. However, the study of escalation control stagnated after the end of the Cold War. This GRP strives to revisit escalation control in two major phases. First, a qualitative literature review regarding escalation control and nuclear deterrence is used to formulate a qualitative interview question set aimed at a broad 'Whole of Government' research base. This interview pool includes senior leaders and experts across the Department of Defense (DoD), Department of Energy (DoE), and the US Government. The qualitative research interview combines the top ten escalation control principles found in the literature, and attempts to detect post-Cold War changes in escalation control dynamics. In the second phase of this study, quantitative analysis will be utilized to establish which areas of escalation control the USAF can improve upon. The areas of improvement recommended by this research include; 1) auditing conventional plans for adversary nuclear thresholds, 2) building more confidence in adversary behavior modeling, and 3) introduction of nuclear escalation control objectives into conventional Mission Type Orders (MTO).





Methodology

Phase I relied on a qualitative literature review on escalation control. The top ten escalation control principles were then established from the literature. Nuclear deterrence theory and escalation control theory documents were sourced from 1950's to present.

Phase II incorporated the ten escalation control principles into an interview questionnaire. The interviews included respondents from a 'Whole of Government' aperture. Participants included seven senior leaders from the Department of Defense (DoD), seven top officials from the Department of Energy (DoE), and seven top officials from the U.S. Government (Senate and House Armed Service Committee-SASC/HASC). The interview utilized overt investigative questions and insidious discussion in order to preserve a genuine response from the respondents. Each design parameter was associated with a specific set of responses. Descriptive statistical analysis was used to determine which response would be considered the senior leader's choice. The selected response would become a numeric variable that would be used to generate a bar graph which enabled both visual and statistical analysis.

Research Goals

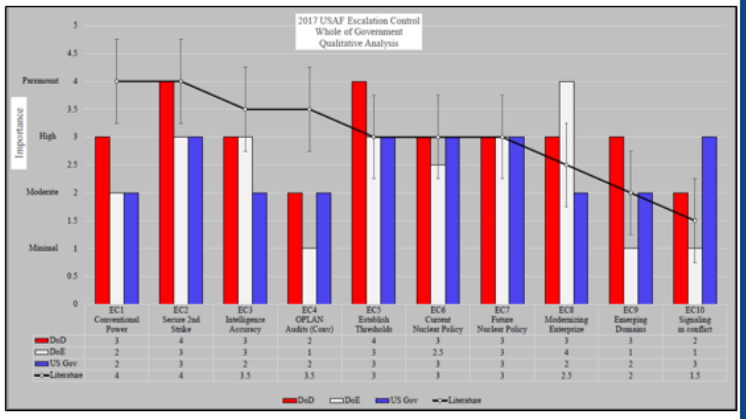
Utilize a 'Whole of Government' scope to ascertain status of post Cold-War escalation control principles using a Mixed method research (Qualitative Literature Review, Qualitative Interview, Quantitative Analysis) was used based on the ability to garner meaningful insight of the study's topic. Mixed method research is valuable for researchers to interpret and define complex situations. Supporting the overarching research question, this study incorporated three investigative questions.

RQ. How can the USAF modernize and operationalize Escalation Control?

IQ1. How effective is the USAF at Escalation Control?

IQ2. What emerging dynamics affect Escalation Control?

IQ3. How can the USAF improve Escalation Control?



Recommendations

1. Increase utilization of available adversary behavior models in order to increase senior leader, strategists, and planner awareness of adversary risk adversity with improved intelligence reports.
2. Immediately audit conventional OPLANs and conventional strike options to ensure CURRENT and FUTURE adversary nuclear thresholds are not inadvertently crossed during conventional conflict. Swiftly disseminate emerging thresholds to conventional strategists and planners.
3. JFACC introduce escalation control objectives into Mission Type Orders (MTO) to enable strategy and planner level fidelity and drive intelligence requirements to assess adversary thresholds.

Bibliography

Bartles, Charles. *Getting Gerasimov Right.* Military Review, Jan-Feb 2016.

Betts, R. K. *Nuclear Blackmail and Nuclear Balance*. Washington, DC: Brookings, 1987.

Blainey, G.. *The Causes of War*. 3rd ed. New York: Free Press, 1988.

Brodie, B. *Unlimited Weapons and Limited War*. The Reporter, November 18. 1954.

Brodie, B. *The Anatomy of Deterrence*. World Politics, 1959.

Bryman, Alan. *Social Research Methods, 2nd Ed*. New York, NY: Oxford University Press.

Carlson, L. J. *A Theory of Escalation and International Conflict*. Journal of Conflict Resolution 39: 511–534, 1994.

Carter, Aston. US Secretary of Defense. "Visiting the Nuclear Enterprise." Address to Air Force Institute of Technology students and School of Advanced Nuclear Deterrence Studies faculty. SANDS, Kirtland AFB, NM. Personal interview. November 2016.

Creedon, Madelyn. *Summary of DoD Internal Nuclear Enterprise Review.* Statement of the Honorable Madelyn Creedon Co-Chair of the Department of Defense's Internal Nuclear Enterprise Review and Principal Deputy Administrator National Nuclear Security Administration U.S. Department of Energy on the Air Force and Navy Nuclear , Washington D.C.: Department of Defense, 2015.

Danilovic, V. *When the Stakes are High: Deterrence and Conflict Among Major Powers.* Ann Arbor: University of Michigan Press, 2002.

Daft, Richard L. *Organization Theory & Design, ed 11e.* Mason, OH: South-Western, 2013.

Donley, Michael B. "Air Force Nuclear Enterprise." *Air Force Policy Directive 13-5.* Washington D.C.: Air Force Departmental Publishing Office, July 6, 2011,

Fanning, Eric K., and General Mark A. Welsh III. *Flight Plan for the Air Force Nuclear Enterprise.* Flight Plan, Washington D.C.: Department of the Air Force, 2013,

Freedman, L. On the tiger's back: The development of the concept of escalation. In The logic of nuclear terror, ed. R. Kolkowitz, 109–152. Boston: Allen & Unwin, 1987.

FIP, AFGSC. *Bomber Force Improvement Program.* Bossier City: Air Force Global Strike Command, 2014.

FIP, AFGSC. *ICBM Force Improvement Program.* Bossier City, LA: Air Force Global Strike Command, 2014.

Flick, Uwe. *An Introduction to Qualitative Research.* London: Sage, 2014.

Freedman, L. *The evolution of nuclear strategy*. 2nd ed. New York: St. Martin's, 1989.

Gacek, C. M. *The logic of force: The dilemma of limited war in American foreign policy.* New York: Columbia University Press, 1994.

General Larry D. Welch (Ret) and Admiral John C. Harvery (Ret). *Independent Review of the Department of Defense Nuclear Enterprise.* Washington D.C.: Department of Defense, 2014.

Haney, Cecil. *Strategic Deterrence*. Commader USSTRATCOM Speech. Omaha, Nebraska: Department of Defense, July 2016.

Hagel, Chuck. *Statement on the Nuclear Enterprise Review and Reforms.* Secretary of Defense Speech. Washington D.C.: Department of Defense, November 14, 2014.

Huth, P. K. *Deterrence and international conflict: Empirical findings and theoretical debates*. Annual Review of Political Science, 1999.

Huth, P. K., and B. M. Russett. *Deterrence failure and crisis escalation*. International Studies Quarterly 32: 29–45, 1988.

Jervis, R. *Perception and misperception in international politics*. Princeton, NJ: Princeton University Press, 1976.

Joint Publication 1-02. Department of Defense Dictionary of Military and Associated Terms. Washington D.C.: Department of Defense Publication Office, 2010.

Kahn, Herman. *On thermonuclear war*. Princeton, NJ: Princeton University Press, 1960.

Kahn, Herman. *Thinking about the unthinkable*. New York: Horizon Press, 1962.

Kahn, Herman. *On escalation*. New York: Praeger, 1965.

Kaufmann,W. *The Requirements of Deterrence*. Military Policy and National Security, ed.W, 1956.

Kissinger, H. A. *Nuclear Weapons and Foreign Policy*. New York: Harper, 1957.

Kohlbacher, Florian. *The Use of Qualitative Content Analysis in Case Study Research*. Forum: Qualitative Social Research. January 2006, Vol 7, No. 1, Article 21. http://www.qualitative-research.net/index.php/fqs/article/view/75/153

Krauthammer, C. *The Terrible Logic of Nukes*. Time, September 2, 2002.

Kunsman, David M. and Douglas B. Lawson. *A Primer on U.S. Strategic Nuclear Policy*. Sandia Report # SAND2001-0053. Albuquerque, NM: Sandia National Laboratories, 2001.

Lebow, R. N. *Between Peace and War: The Nature of International Crisis*. Baltimore, MD: The Johns Hopkins University Press, 1981.

Lin, Herbert. *Escalation Dynamics and Conflict Termination in Cyberspace.* Strategic Studies Quarterly, Fall 2012.

Massie, R. K. *Dreadnought: Britain, Germany, and the coming of the Great War*. New York: Ballantine Books, 1991.

Maxwell, S. *Rationality in Deterrence.* Adelphi Paper no. 50. London: Institute for Strategic Studies, 1968.

Murdock, Clark A. *The Department of Defense and the Nuclear Mission in the 21st Century.* Washington D.C.: Center for Strategic and International Studies, 2008.

Nalebuff, B. *Brinkmanship and nuclear deterrence: The neutrality of escalation.* Conflict Management and Peace Science, 1986.

Ormrod, Paul D. Leedy and Jeanne Ellis. *Practical Research: PLanning and Design, 11th ed*. Upper Saddle River, NJ: Pearson Education Inc., 2013.

Posen, Barry. *Inadvertent Nuclear War? Escalation and NATO's Northern Flank.* International Security, the MIT Press, Fall 1982.

Peyer, Major General Polly A. *Air Force Blue Ribbon Review of Nuclear Weapons Policies and Procedures*. Washington D.C.: Department of the Air Force, 2008.

Osgood, R. E. *Limited war: The challenge to American strategy*. Chicago: University of Chicago Press, 1957.

Payne, Keith. *The Great American Gamble.* Fairfax, VA: National Institute Press, 2008.

Powell, R. *Crisis Bargaining, Escalation, and MAD*. American Political Science Review, 1987.

Richardson, L. F. *Arms and Insecurity: A mathematical Study of the Causes and Origin of War.* Pittsburgh: Boxwood Press, 1960.

D. M. Kilgour and F. C. Zagare Richardson, J. L. *Crisis Diplomacy: The Great Powers Since the Mid-Nineteenth Century.* New York: Cambridge University Press, 1994.

Schelling, Thomas C. *The Strategy of Conflict*. Cambridge: Harvard University Press, 1960.

Schelling, Thomas C. *Arms and Influence*. New Haven, CT: Yale University Press, 1966.

Selten, R. *A Re-Examination of the Perfectness Concept for Equilibrium Points in Extensive Games*. International Journal of Game Theory, 1975.

Smoke, R. *War: Controlling escalation*. Cambridge: Harvard University Press, 1977.

Singh, Kultar. *Quantitative Social Research Methods*. New Dehli: Sage Publications India Pvt Ltd, 2007.

Snyder, G. H., and P. Diesing. *Conflict among nations: Bargaining, decision making and system structure in international crises*. Princeton, NJ: Princeton University Press, 1977.

Trachtenberg, M. *History and strategy*. Princeton, NJ: Princeton University Press, 1991.

Tuchman, B. *The Guns of August*. New York: Dell, 1962.

Yin, Robert K. *Case Study Research: Design and Methods, 4th ed.* London: Sage, 2009.

Young, O. R. *The Politics of Force: Bargaining During International Crises*. Princeton, NJ: Princeton University Press, 1968.

Zagare F. C. *Reconciling rationality with deterrence: A re-examination of the logical Foundations of deterrence theory*. Journal of Theoretical Politics, 2004.

Zagare F. C. *Classical Deterrence Theory: A Critical Assessment*. International Interactions, 1996.

Zagare, F. C. *The Dynamics of Deterrence*. Chicago: University of Chicago Press, 1987.

Zagare, F. C., and D. M. Kilgour. *Perfect Deterrence*. Cambridge: Cambridge University Press, 2000.

Zagare, F. C., and D. M. Kilgour. *Deterrence Theory and the Spiral Model Revisited.* Journal of Theoretical Politics, 1998.

Zagare, F. C., and D. M. Kilgour. *Assessing Competing Defense Postures: The Strategic Implications of Flexible Response*. World Politics. 1995.

Zagare, F. C., and D. M. Kilgour. *Modeling Massive Retaliation*. Conflict Management and Peace Science, 1993.

Vita

Major Justin Gamel is currently a student at the School of Advanced Nuclear Deterrence Studies (SANDS), a 12 month in-resident Intermediate Developmental Education program based at Kirtland AFB, New Mexico. SANDS partners closely with the Air Force Institute of Technology (AFIT) in developing DOD officers, civilians, and coalition members as experts within the nuclear enterprise. SANDS/AFIT graduates are developed to be Nuclear Deterrence experts who will fill command and staff positions within the Air Force, Defense Department, various combatant commands, Joint staff, and NATO organizations. Major Gamel previously served as the 36th Wing Weapons Officer, Assistant Director of Operations, and Unit Datalink Manager for the 36th Operational Support Squadron. As the 36th WWO he supported 24/7 expeditionary operations for fighter, bomber, ISR, tanker, airlift, helicopter, and U.S. Army Terminal High Altitude Area Defense. He also developed the 36th Wing Operations Center in support of Operation Noble Eagle, networking over $15M in datalink infrastructure which now contributes to the Joint Guam Common Operating Picture.

Major Gamel was commissioned in May 2003 after graduating from Texas A&M University through the Air Force ROTC and Corps of Cadets program. He has over 2,200 hours in the B-52H with 337 combat hours.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
15-06-2017	Graduate Research Paper	JUN 2016 – JUL 2017

4. TITLE AND SUBTITLE
MODERNIZING USAF ESCALATION CONTROL

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Gamel, Justin L. Major, USAF

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way, Building 640
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT-ENS-MS-17-J-027

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Intentionally Left Blank – No Sponsor

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution Statement A. Approved for Public Release; Distribution Unlimited.

13. SUPPLEMENTARY NOTES
This material is declared a work of the U.S. Government and is not subject to copyright protection in the United States.

14. ABSTRACT

This Graduate Research Project (GRP) will assess how the United States Air Force (USAF) can implement escalation control operations. Escalation control theory models were once capable of predicting escalation with an accuracy up to 98%. However, the study of escalation control stagnated after the end of the Cold War. This GRP strives to revisit escalation control in two major phases. First, a qualitative literature review regarding escalation control and nuclear deterrence is used to formulate a qualitative interview question set aimed at a broad 'Whole of Government' research base. This interview pool includes senior leaders and experts across the Department of Defense (DoD), Department of Energy (DoE), and the US Government. The qualitative research interview combines the top ten escalation control principles found in the literature, and attempts to detect post-Cold War changes in escalation control dynamics. In the second phase of this study, quantitative analysis will be utilized to establish which areas of escalation control the USAF can improve upon. The areas of improvement recommended by this research include; 1) auditing conventional plans for adversary nuclear thresholds, 2) building more confidence in adversary behavior modeling, and 3) introduction of nuclear escalation control objectives into conventional Mission Type Orders (MTO).

15. SUBJECT TERMS
Nuclear Deterrence, Deterrence Theory, Escalation Control, Escalation Dominance, Escalation to De-escalate, Strategic Off-Ramps, Escalation Termination, Signaling, Thresholds, Red Lines, Milestones, Limited War, Inadvertent Escalation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Heidi M. Tucholski, Maj, Ph.D., USAF
U	U	U	UU	91	19b. TELEPHONE NUMBER *(Include area code)* (937) 255-3636, x 4319 (Heidi.Tucholski@afit.edu)

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18